

Appendix A

Instruments and Products, Used in Hospitals, That May Contain Mercury

(This list should not be assumed to be complete.)

Thermometers

- Body temperature thermometers
- Clerget sugar test thermometers
- Heating and cooling system thermometers
- Incubator/water bath thermometers
- Minimum/maximum thermometers
- National Institute of Standards and Technology calibration thermometers
- Tapered bulb (armored) thermometers

Sphygmomanometers

Gastrointestinal tubes

- Cantor tubes
- Esophageal dilators (bougie tubes)
- Feeding tubes
- Miller Abbott tubes

Dental amalgam

Pharmaceutical supplies

- Contact lens solutions and other ophthalmic products containing thimerosal, phenylmercuric acetate or phenylmercuric nitrate
- Diuretics with mersalyl and mercury salts
- Early pregnancy test kits with mercury-containing preservative
- Merbromin/water solution
- Nasal spray with thimerosal, phenylmercuric acetate or phenylmercuric nitrate
- Vaccines with thimerosal (primarily in hemophilus, hepatitis, rabies, tetanus, influenza, diphtheria and pertussis vaccines)

Cleaners and degreasers with mercury-contaminated caustic soda or chlorine

Batteries (medical uses)

- Alarms
- Blood analyzers
- Defibrillators
- Hearing aids
- Meters
- Monitors
- Pacemakers
- Pumps
- Scales
- Telemetry transmitters
- Ultrasound
- Ventilators



Batteries (non-medical uses)

Lamps

Fluorescent

Germicidal

High-intensity discharge (high pressure sodium, mercury vapor, metal halide)

Ultraviolet

Electrical equipment

Tilt switches

Air flow/fan limit control

Building security systems

Chest freezer lids

Fire alarm box switches

Lap-top computer screen shut-off

Pressure control (mounted on bourdon tube or diaphragm)

Silent light switches (single-pole and three-way)

Temperature control (mounted on bimetal coil or attached to bulb device)

Washing machine (power shut off)

Float control

Septic tanks

Sump pumps

Thermostats (non-digital)

Thermostat probes in electrical equipment

Reed relays (low voltage, high precision analytical equipment)

Plunger or displacement relays (high current/high voltage applications)

Thermostat probes in gas appliances (flame sensors, gas safety valves)

Pressure gauges

Barometers

Manometers

Vacuum gauges

Other

Devices, such as personal computers, that utilize a printed wire board

Blood gas analyzer reference electrode (Radiometer brand)

Cathode-ray oscilloscope

DC watt hour meters (Duncan)

Electron microscope (mercury may be used as a damper)

Flow meters

Generators

Hitachi Chem Analyzer reagent

Lead analyzer electrode (ESA model 3010B)

Sequential Multi-Channel Autoanalyzer (SMCA) AU 2000

Vibration meters



Appendix B

Laboratory Chemicals That May Contain Mercury (Compiled in 1997)

This list is intended to demonstrate the wide variety of laboratory chemicals that may contain mercury. It was derived from examining the Massachusetts Water Resources Authority Mercury Source Identification Program Database (See *Appendix L*, Mercury Reduction Case Studies, and *Appendix J*, Educational Resources for a Mercury Pollution Prevention Program).

Some of the chemicals may contain added mercury, and others may contain mercury as a contaminant in a feedstock. If the mercury is a contaminant, its presence or absence may vary from lot to lot. In the case of kits, it is necessary to consider separately each of the reagents that make up the kit.

This list should not be assumed to be complete. Request that vendors disclose mercury concentration on a Certificate of Analysis for all chemicals ordered. See *Appendix H* for a sample letter requesting mercury information and sample Certificate of Analysis.

Acetic acid	Immu-sal
Ammonium reagent/Stone analysis kit	Liquid substrate concentrates and diluents
Antibody test kits	Negative control kits
Antigens	Phenobarbital reagent
Antiserums	Phenytoin reagent
Buffers	Positive control kits
Calibration kits	Potassium hydroxide
Calibrators	Pregnancy test kits
Chloride	Rabbit serum
Conjugate kits	Shigella bacteria
Diluents	Sodium hypochlorite
Enzyme immunoassay test kits	Stains
Enzyme tracers	Standards
Ethanol	Substance abuse test kits
Extraction enzymes	Sulfuric acid
Fixatives	Thimerosal
Hematology reagents	Tracer kits
Hormones	Urine analysis reagents
Immunoelectrophoresis reagents	Wash solutions
Immunofixationphoresis reagents	



Appendix C

Regulatory Information Contacts for Counties in the Rochester Embayment Watershed

Wastewater Regulations

NYS Department of Environmental Conservation (NYSDEC), Region 8
(Counties of Genesee, Livingston, Monroe, Ontario)
Division of Water
6274 East Avon-Lima Road
Avon, NY 14414
716-226-2466

NYSDEC, Region 9 (Counties of Allegany, Wyoming)
Division of Water
270 Michigan Avenue
Buffalo, NY 14203-2999
716-851-7070

Allegany County, New York
Public Health Director
Allegany County Health Department
County Office Building
Belmont, NY 14813
716-268-9254

Genesee County, New York
NYSDEC Region 8; also contact the municipality

Livingston County, New York
Environmental Health Director
Livingston County Health Department
2 Livingston County Campus
Mount Morris, NY 14510-1691
716-243-7280

Monroe County, New York
Industrial Waste Control Section
Monroe County Department of
Environmental Services
444 East Henrietta Road
Rochester, NY 14620
716-274-8102

Ontario County, New York
Cornell Cooperative Extension,
Ontario County
480 North Main St.
Canandaigua, NY 14424
716-394-4110

Wyoming County, New York
Public system: NYSDEC Region 9
Private system: Public Health Engineer
Wyoming County Health Department
338 North Main St.
Warsaw, NY 14569
716-237-2666



Hazardous Waste Regulations

NYSDEC, Albany

Bureau of Hazardous Waste Management
Division of Solid and Hazardous Materials
50 Wolf Road
Albany, NY 12233
518-485-8988

NYSDEC, Region 8

(Counties of Genesee, Livingston, Monroe, Ontario)
Division of Solid and Hazardous Materials
6274 East Avon-Lima Road
Avon, NY 14414
716-226-2466

NYSDEC, Region 9 (Counties of Allegany, Wyoming)

Division of Solid and Hazardous Materials
270 Michigan Avenue
Buffalo, NY 14203-2999
716-851-7220

Air Regulations

NYSDEC, Region 8 (Counties of Genesee, Livingston, Monroe, Ontario)

Air Pollution Control Program
6274 East Avon-Lima Road
Avon, NY 14414
716-226-2466

NYSDEC, Region 9 (Counties of Allegany, Wyoming)

Division of Air Resources
270 Michigan Avenue
Buffalo, NY 14203-2999
716-851-7130



Appendix D

Benefits of a Mercury Pollution Prevention Program in Your Hospital (Handouts)

Addresses Human Health Concerns About Mercury in the Environment

- There are human health impacts due to eating mercury-contaminated fish and fish consumption advisories due to mercury
- Health professionals practice preventive medicine for public health.

Reduces Discharge of Mercury into the Environment

- Discharge to the air from incineration, and deposition of the airborne mercury back to the ground or water
- Discharge of mercury in wastewater to sewage treatment plants, and from there to:
 - A waterway, or
 - The air if sludge is incinerated, or
 - The soil if sludge is land spread

Helps to Avoid the Need for Future Environmental Regulations

- As a result of the Federal Great Lakes Water Quality Guidance (also referred to as the Great Lakes Initiative), New York State adopted a stricter water quality standard for mercury that allows virtually no discharge of mercury.
- The hospital may not be able to meet stricter state standards for discharge to the sewage treatment plant without action.
- Implementing best management practices now can help to avoid the need for increased regulations in the future.

Produces Hospital Operations Efficiencies

- Mercury Pollution Prevention avoids:
 - Disruption of services due to spills
 - High disposal costs of mercury
 - Need to train staff for handling mercury
 - Costs of end-of-pipe treatment that may be needed to meet upcoming regulations
- Mercury alternatives are becoming more readily available and in many cases are cheaper.

Demonstrates Leadership

- Your hospital is a leader in the local medical community.

Examples of What Some Hospitals Are Doing

- See tables





Mercury Pollution Prevention in Select Michigan Hospitals
(Table Compiled by the National Wildlife Federation, August 1995)

Pollution Prevention Actions	Bronson, Kalamazoo	Butterworth, Grand Rapids	Henry Ford, Detroit	Genesys, Flint	Riverside, Trenton	U. Michigan Ann Arbor	Corning Labs, Grand Rapids
Administrative directives - (Formal vs. Informal)	✓F	✓F	✓F	✓F	✓I	✓I	✓F
Clean drain traps/catch basins			✓		✓		✓
Educate staff	✓	✓	✓	✓	✓	✓	✓
Install energy efficient lighting			✓		✓	✓	
Inventory mercury uses		✓	✓		✓	✓	✓
Mercury-free batteries	✓	✓	✓	✓	✓	✓	✓
Purchase new mercury-free sphygmomanometers	✓	✓	✓	✓	✓	✓	N/A
Replace broken sphygmomanometers with mercury-free units	✓	✓	✓	✓	✓	✓	N/A
Replace mercury thermometers	✓	✓	✓	✓	✓	✓	
Separate wastes		✓	✓	✓	✓	✓	✓
Substitute pathology lab reagents					✓		✓
Training on spill prevention and management	✓	✓	✓	✓	✓	✓	✓

Mercury Pollution Prevention Activities In Select North American Health Care Facilities (Table Compiled by Margy Peet, Monroe County Department of Health, Rochester, NY)

Pollution Prevention Actions	Princeton Hospitals, Princeton NJ	Facilities participating in the MWRA/MASCO Mercury Work Group	Hospital for Sick Children, Toronto Hospital & Centenary Health Centre	St. Mary's Hospital, Duluth Minnesota	13 Wisconsin Hospitals
Clean drain traps	✓	✓		✓	
Waste piping power washing		✓			
MOU with POTW (MWRA) to suspend sewer discharge compliance enforcement		✓			
Inventory mercury uses/ waste reduction assessment		✓			✓
Prepared Facilities Loadings Report, Pretreatment Guidance Manual, Technology Identification Report and Mercury Management Guidebook		✓			
Database of mercury content of 8,000 products		✓			
MOU with Government, adopt plans and timetables to reduce or eliminate mercury			✓		
Cost-Effective Alternatives Project			✓		
Replaced mercury thermometers & sphygmomanometers				✓	
Education materials for employees				✓	
Work Group for support & problem solving					✓

Appendix E

Annual Assessment of the Hospital's Mercury Pollution Prevention Program

Use this form for your hospital's baseline mercury assessment before you begin your mercury pollution prevention program. Space is provided to assess progress during four successive years.

Year assessed	Baseline	Year 1	Year 2	Year 3	Year 4
1. Are mercury thermometers still in use? In which departments?					
2. Number of mercury thermometers purchased					
3. Number of mercury thermometers sent home with patients					
4. Are mercury sphygmomanometers still in use? In which departments?					
5. Number of mercury sphygmomanometers purchased					
6. Are mercury gastrointestinal tubes still in use?					
7. Number of mercury gastrointestinal tubes purchased					
8. Is phase-out of mercury laboratory chemicals underway or completed?					
9. Is phase-out of mercury pharmaceutical products underway or completed?					
10. Is phase-out of mercury batteries underway or completed?					
11. Number of mercury batteries purchased					
12. Is phase-out of mercury in electrical equipment underway or completed?					
13. Quantity of mercury waste disposed as hazardous waste					



Year assessed	Baseline	Year 1	Year 2	Year 3	Year 4
14. Quantity of mercury waste recycled					
15. Costs for the recycling and/or disposal of mercury waste					
16. Number of mercury spills					
17. Estimated total quantity of mercury involved for all mercury spills					
18. Is documentation kept for all pertinent staff educated about mercury spill prevention and management?					
19. Percentage of pertinent staff trained about mercury spill prevention and management					
20. Do all pertinent staff know where the mercury vacuum cleaners and/or mercury spill kits are located?					
21. Percentage of pertinent staff that know whom to call for clean-up of a mercury spill					
22. Percentage of maintenance staff that know the proper procedure for trap cleaning in areas where mercury is used					
23. Is training documentation kept for all staff educated about the health and environmental concerns of mercury?					
24. Percentage of staff that has been educated about the health and environmental concerns of mercury					
25. Is there a disclosure about mercury content for each of the products or chemicals used by the hospital?					
26. Percentage of disclosures that are on file (see above)					



Appendix F

Wastewater Sampling and Analysis

Measurement of success is vital to determining the effectiveness of a pollution prevention program. In order to measure success a point of reference needs to be established. This is called a baseline (or starting) point. One of the ways a baseline can be measured is through wastewater monitoring. Be sure to consider all the wastewater lines leaving hospital property.

Both analytical concentration of mercury and the volumes of flow need to be measured. This data should be combined to result in a mass loading of mercury to the sewage treatment facility or receiving stream. All sewage treatment facilities measure discharges the same way. By measuring with the same units as these facilities, apples-to-apples can be compared. Sewage treatment plants in the Great Lakes basin measure mercury in the parts-per-trillion (ppt) range. But upstream, at the source of the mercury, parts-per-billion (ppb) testing *may* be sensitive enough. See below for examples of calculations based on these two concentration ranges.

Mass loading calculation:

$$\frac{\text{Mercury in ppb}}{1,000} \times \text{Flow in mgd}^* \times 8.34^{**} = \text{Mass mercury loading in lbs/day}$$

$$\frac{\text{Mercury in ppt}}{1,000,000} \times \text{Flow in mgd}^* \times 8.34^{**} = \text{Mass mercury loading in lbs/day}$$

This mass loading calculation should be used to calculate your baseline point, to monitor progress, and to help measure program success. This calculation should be done over a period of time. By repeating the flow and analyses, a more accurate status can be determined. Contact a local wastewater testing laboratory to identify options for sample collection and analysis. Clean sampling techniques, as defined by the U.S. Environmental Protection Agency, may be required for very low detection limits. You can monitor your progress by collecting and analyzing samples one to four times per year.

* mgd: million gallons per day

** 8.34 is a set of conversion factors consolidated to one number so that units will work out.

ppb is equivalent to micrograms per liter ($\mu\text{g/L}$).

ppt is equivalent to nanograms per liter (ng/L).



Appendix G

Mercury Pollution Prevention Cost or Savings Worksheets

1. Reusable Product Replaced by a Reusable Product

Proposed product _____
 Current product _____
 Hospital _____
 Prepared by _____
 Date _____

Capital costs of proposed product*

	Description	\$ Cost
Product	_____	_____
Materials	_____	_____
Installation	_____	_____
Utility connections	_____	_____
Engineering	_____	_____
Start-up and training process	_____	_____
Other capital costs	_____	_____
	Total capital costs	\$ _____

Annual Operating Costs

	\$ Current Product Costs	\$ Proposed Product Costs
Disposal	_____	_____
Recycling	_____	_____
Handling	_____	_____
Spill clean-up	_____	_____
Training	_____	_____
Calibration	_____	_____
Other	_____	_____

Annual net operating cost or savings \$ _____

Payback period (in years) = $\frac{\text{Total capital costs}}{\text{Annual net operating cost or savings}}$ = _____

*Depreciation should be considered. Consult with your accounting department about this factor.



Mercury Pollution Prevention Cost or Savings Worksheets

2. Disposable Product Replaced by Disposable Product

Proposed product _____
 Current product _____
 Hospital _____
 Prepared by _____
 Date _____

Annual cost of proposed product

					\$ Annual Cost
Product	\$ _____	@ x # purchased annually _____	=	_____	
Disposal	\$ _____	@ x # purchased annually _____	=	_____	
Recycling	\$ _____	@ x # purchased annually _____	=	_____	
Handling				_____	
Spill Clean-up				_____	
Training				_____	
Calibration				_____	
Other				_____	

Total annual cost of proposed product \$ _____

Annual cost of current product

					\$ Annual Cost
Product	\$ _____	@ x # purchased annually _____	=	_____	
Disposal	\$ _____	@ x # purchased annually _____	=	_____	
Recycling	\$ _____	@ x # purchased annually _____	=	_____	
Handling				_____	
Spill Clean-up				_____	
Training				_____	
Calibration				_____	
Other				_____	

Total annual cost of current product \$ _____

Total annual cost of current product \$ _____

Total annual cost of proposed product - \$ _____

Annual net cost of savings of proposed product = \$ _____



Mercury Pollution Prevention Cost or Savings Worksheets

3. Disposable Product Replaced by a Reusable Product

Proposed product _____
 Current product _____
 Hospital _____
 Prepared by _____ Date _____

Capital costs of proposed product*	Description	\$ Cost
Product	_____	_____
Materials	_____	_____
Installation	_____	_____
Utility connections	_____	_____
Engineering	_____	_____
Start-up and training process	_____	_____
Other capital costs	_____	_____
Total capital costs		\$ _____

Expected lifetime of product _____ years

$$\frac{\text{Total capital costs}}{\text{Expected lifetime of product}} = \text{Annualized capital cost} = \$ \underline{\hspace{2cm}}$$

Annual cost of current product **\$ Annual Cost**
 Product \$ _____ @ x # purchased annually _____ = _____

Annual Operating Costs	\$ Current Product Costs	\$ Proposed Product Costs
Annualized capital cost of proposed product		_____
Annual capital cost of current product	_____	
Disposal	_____	_____
Recycling	_____	_____
Handling	_____	_____
Spill clean-up	_____	_____
Training	_____	_____
Calibration	_____	_____
Other _____	_____	_____
Total annual cost of current product	\$ _____	
Total annual cost of proposed product	\$ _____	\$ _____
Net cost of savings of proposed product	\$ _____	

*Depreciation should be considered. Consult with your accounting department about this factor.



Appendix H

Sample Letter Requesting Certificate of Analysis
and Sample Certificate of Analysis
(Adapted from sample prepared by Western Lake Superior Sanitary District)

University Memorial Medical Center

January 2, 1997

Mary Smith
Director of Sales
Mercury Laboratory Products
40 Third Street
Duluth, MN 55805

Subject: Certificate of Analysis

Dear Ms. Smith:

As you are aware, mercury is ever increasingly becoming a concern as an environmental pollutant. Mercury released from air and water sources is transformed into methylmercury in lakes or rivers. The methylmercury bioaccumulates in the aquatic food chain making consumption of fish hazardous to those organisms high on the food chain. As a result, regulations on the discharge of mercury to the solid and wastewater stream are becoming increasingly stringent.

Because of this knowledge, and our concern for the environment, our institution has instituted a mercury reduction policy. This policy requires the elimination or minimization of mercury in all our purchases. Low level concentrations of mercury in products (less than 10,000 ppm or one percent) are not required to be listed on Material Safety Data Sheets. The contribution from the sum of these low concentration sources accounts for a large fraction of the mercury in the wastewater stream. In order for our purchasing department to be able to make an informed choice on mercury concentration within the products that it buys, we are requesting that all vendors supply us with a certificate of analysis and/or a notarized affidavit which describes product mercury concentration and the detection method used in the analysis. This information will be used along with other criteria in the selection process of our vendors.

Please submit the aforementioned information on all products that you intend to supply our institution. Thank you for your understanding and assistance in this matter.

Sincerely

Jane Doe
Purchasing



Sample Certificate of Analysis

(Adapted from sample prepared by Western Lake Superior Sanitary District)

Anderson's Acids
98 Molarity Drive
Marathon, Ontario
H2S O4 CANADA

Customer : Acme Manufacturing, Inc.

Attn: John Jefferson
Fax : 1-800-555-5555

Product Grade : SULFURIC ACID 93% Shipment Date : 09/03/96

B/L Number : 00008650

Quantity (as is): 100.400
T

Customer P/O No.: C125062

Routing : ONR-HEARST-AC-SSTMA-WC-SUPER-BN-CLOQ-DNE

Tank Car/Tank Truck No. :
UTLX125021

The analysis below is representative of the quality of product loaded into the above shipment.

Parameter	Analysis	Specification
Strength (% H ₂ SO ₄)	93.67	93.19 Min
Color (HU)	11	40 MAX
Iron (ppm Fe)	9	50 MAX
Sulfur Dioxide (ppm SO ₂)	10	50 MAX
Appearance (%T)	100	
Oxides of Nitrogen (ppm NO ₃)	1	10 MAX
POM (ml 0.02N KMnO ₄)	1.00	5.00 MAX
Mercury (ppb)	60	

Detection method for mercury analysis _____

ANALYST :



Appendix I

Vendor Product Mercury-Content Disclosure

Hospital name _____
 Name of Hospital Purchasing Agent _____
 Address _____

 Telephone _____ Fax _____

The above-named Hospital has the policy of minimizing the use of mercury in products purchased for the Hospital. Such products may include:

Barometers	Lamps
Batteries	Pharmaceutical products
Cleansers and soaps	Sphygmomanometers
Electrical relays	Switches
Gastrointestinal tubes	Thermometers
Laboratory chemicals	Thermostat probes
Laboratory manometers	Thermostats

Vendor name _____
 Name of vendor's agent _____
 Address _____

 Telephone _____ Fax _____

The above-named vendor agrees to:

- Assist _____ Hospital in obtaining manufacturers' disclosures about the mercury content of their products.
- Assist _____ Hospital in selecting products that are virtually free of mercury content.

 Signature of vendor's agent

 Date



Appendix J

Educational Resources for a Mercury Pollution Prevention Program

MWRA/MASCO Mercury Work Group

Karen Rondeau
617-241-2347

Mercury Products Database, computerized listing of 8,000 chemicals in Microsoft Access™ (free)

Facilities Loadings Subgroup Report (39 pages plus appendices, free)

Mercury Management Guidebook (30 pages plus appendices, free)

Pretreatment Guidance Manual (47 pages plus appendices, free)

Technology Identification Subgroup Report (30 pages plus appendices, free)

(See also listing for the MASCO Internet site)

Minnesota Office of Environmental Assistance

Emily Moore
520 Lafayette Rd. N., 2nd Floor
St. Paul, MN 55155-4100
612-215-0201
FAX 612-215-0246

Video (inquire about availability)

National Wildlife Federation**Great Lakes Natural Resource Center**

506 E. Liberty, 2nd Floor
Ann Arbor, MI 48104-2210
313-769-3351

Mercury Pollution Prevention in Healthcare: A Prescription for Success (42 pages, \$6.00)

Terrene Institute

4 Herbert Street
Alexandria, VA 22305
703-548-5473
FAX: 703-548-6299
E-Mail: Terrinst@aol.com

The Case Against Mercury: Rx for Pollution Prevention (one of two sources for ten-page booklet and poster, free)



U.S. Environmental Protection Agency

Region V
Chris Urban
Attn: WW-16J
77 West Jackson Blvd.
Chicago, IL 60604
312-886-3493

The Case Against Mercury: Rx for Pollution Prevention (one of two sources for ten-page booklet and poster, free)

General outreach materials (free)

Video (inquire about availability)

Western Lake Superior Sanitary District

Jamie Harvie
2626 Courtland St.
Duluth, MN 55806-1894
218-722-3336, ext. 307

MercAlert (pamphlet for consumers, free)
Blueprint for Mercury Elimination: Mercury Reduction Project Guidance for Wastewater Treatment Plants (38-page book of interest beyond wastewater treatment plants, free)

Internet Sites:

(Massachusetts) Medical, Academic and Scientific Community Organization (MASCO)
www.masco.org/mercury

Massachusetts Water Resources Authority
www.mwra.state.ma.us

Michigan Department of Environmental Quality
www.deq.state.mi.us/ead/p2sect/mercury

National Wildlife Federation
www.igc.org/nwf/greatlakes/pp/hosprpt

U.S. Environmental Protection Agency
www.epa.gov/seahome/mercury/src/outmerc

For additional resources, see Appendix L, Mercury Reduction Case Studies, and Appendix R, Bibliography.



Appendix K

Disposal of *Take-Home Household* Mercury Thermometers by Patients

You have been given a mercury thermometer to take home with you at the end of your stay in the hospital. Of course, a mercury thermometer is safe to use as long as the thermometer is intact. However, if the thermometer breaks or is discarded improperly, the mercury may contribute to an environmental problem.

If a mercury thermometer breaks, wear plastic gloves during the clean-up process. The mercury can be gathered using one or two index cards as scoops. Transparent or masking tape can be used to blot up the residue. Double-bag the mercury and cleanup materials in plastic resealable bags and place them into a rigid plastic container.

Dispose of broken and unbroken mercury thermometers at the household hazardous waste facility in the county in which you live.

GLOW (Counties of Genesee, Livingston, Orleans, Wyoming): GLOW conducts household hazardous waste collection days. Call 716-344-4035 or the GLOW recycling hotline at 800-836-1154 to be notified when a collection day will be held and to receive packaging instructions.

Monroe County: Materials containing mercury can be dropped off without an appointment in the Industrial Waste Office foyer of Building 15 at 444 East Henrietta Road in Rochester. The foyer is open from 7:00 a.m. to 4:30 p.m. Monday through Friday. For any other household hazardous waste, call the Household Hazardous Waste Facility at 716-760-7600 to make an appointment.

Ontario County: Ontario County holds a household hazardous waste collection day once a year for County residents. For further information, call the Ontario County Recycling Hotline at 800-836-7678.

Western Finger Lakes Solid Waste Management Authority (Counties of Seneca, Wayne, Yates): Call 800-724-3867 to learn the date of the next household hazardous waste collection.



Appendix L

Mercury Reduction Case Studies

1. Strong Memorial Hospital, Rochester, New York

When the Monroe County Department of Health decided to form a Mercury Pollution Prevention Task Force it contacted and received cooperation from a faculty member of the University of Rochester Medical Center's Environmental Health Science Department. A student in the Master's program for Environmental Studies performed initial fact finding as part of a project for a Master of Science degree.

No University or Strong Memorial Hospital administrator was contacted formally by the County until the initial "kick-off" meeting. Informal communication between a faculty member and the University's Director of Environmental Health and Safety prior to the kick-off meeting was not adequate to outline the project intent or scope. The net result was that it took over a year to work out a Memorandum of Understanding (MOU) that was acceptable to all parties involved. Once top administrative staff were on board the rate of progress and access to the facility improved dramatically. This experience yielded Lesson 1: Identify and involve all appropriate facility management in the process before predetermining a program's scope and desired outcome.

The intern wrote a comprehensive report which detailed the status quo of mercury usage and management at the University of Rochester Strong Memorial Hospital (SMH). In addition, other undergraduate interns, along with members of University/SMH staff, investigated mercury usage and gathered existing policies/protocols (official and unofficial). The findings were as follows:

1. Mercury thermometers were being used in cases of isolation patients and in-patient care units where electronic thermometers were deemed inappropriate. These units included Newborn and the Neonatal Care Units. Six units were identified as using over half the mercury thermometers at SMH. The rest of the Hospital used non-mercury devices. The Director of Medical Engineering stated that over 1.14 million non-mercury temperatures were taken at SMH during 1996 and that the phase-out would continue as more equipment was purchased.
2. Mercury-filled sphygmomanometers were being phased out as the equipment needed replacement. All new construction and renovations included aneroid blood pressure reading devices.
3. Gastrointestinal devices that contained mercury were generally being replaced with tungsten-filled equipment unless there was a medical reason for not doing so.
4. Laboratory reagents, such as histology fixatives and stains, that contained mercury had not been used since 1992. Only those reagents or procedures in which mercury could not be substituted or were not known to contain mercury were still being used in the Clinical Laboratories.



5. Noncontact dental amalgam was being collected for proper disposal.
6. Energy efficient lighting was installed as a part of the USEPA Green Lights Program. High mercury T-12 lamps were replaced by lower mercury T-8 lamps.
7. Fluorescent lamps that failed Toxicity Characteristic Leaching Procedure (TCLP) testing were being collected and disposed of as hazardous waste.
8. Mercury spill protocols were long established (at least since 1983). These were current and the staff trained periodically. A log book of spills was being maintained. In fact, SMH owned a special mercury vacuum cleaner with activated carbon filters for vapor control. An industrial hygienist used a mercury vapor “sniffer” to determine if spill cleanup efforts were successful. The earliest record of a mercury “sniffer” being used at the facility was in the early 1980s. There was also a pre-existing mercury disposal/spill protocol for Nursing Units in existence since 1983 that has been updated periodically.
9. Hazardous waste, including mercury, was being collected via a formal program and shipped to off-site facilities for disposal.
10. Battery collection sites were already established throughout the Medical Center to prevent batteries from being incinerated. In addition, a letter was on file stating that the alkaline batteries purchased under the University contract contained no added mercury.
11. Monthly monitoring for mercury vapors was being performed by an industrial hygienist in areas where mercury equipment was being repaired or stored.

Areas of concern included:

- Initial testing of the wastewater effluent showed mercury levels of 0.8 ppb. This would be required to be reduced once the Great Lakes Water Quality Initiative standards were adopted.
- Existing policy was sometimes decentralized. Gathering information was sometimes difficult and the results from questionnaires or other queries could be conflicting. There was no mercury thermometer take-home policy.
- Substitutes for mercury are still to be identified for thermometers in some applications at SMH.
- Mercury as a contaminant needs to be addressed for various lab reagents and cleaning compounds.
- Mercury pollution prevention training needs to be incorporated into as many pre-existing training programs as feasible.
- Contact amalgam (amalgam that has been in the patient’s mouth) was being considered regulated medical waste.
- Mercury thermometers from isolation patient care rooms were being considered regulated medical waste.
- Nursing staff surveys indicated that not all staff understood fully what to do with used mercury thermometers or with mercury in the event of a spill, in spite of existing policy and training. Similar knowledge gaps were also discovered in other areas of the institution.

This information led to Lesson 2: In spite of policy or training, there are always items that can fall through the cracks. It pays to compare practice with policy in order to identify and solve a problem.



A Mercury Work Group was established at SMH. It included representatives of:

Administration	Housekeeping
Clinical Laboratories	Medical Engineering Laboratory
County Health Department	Nursing Practice
Dentistry	Procurement
Education	Quality Assurance
Environmental Health and Safety	Stores
Facilities	

The Hospital's mercury pollution prevention program accelerated after the formation of the Work Group in the following areas:

Elimination of mercury

- Non-mercury thermometers were identified and tested in some of the areas where no substitute was previously identified.
- Some nursing units no longer give out take-home thermometers.
- Laboratories were surveyed to verify that mercury was still no longer being used. If discovered, the use and disposal route were determined.
- Mercury sphygmomanometer replacement was tracked more closely and the rate of replacement increased.

Education

- Mercury-specific training was included in the annual required training video. A specific test question about mercury disposal was included. Also a new segment about mercury was added to the Facilities Operations and Maintenance training presentation.
- Educational packets were created for nursing managers and the housekeeping supervisor.
- A mercury survey for nursing personnel was developed that was intended to be used both before and after training. (See survey at the end of this case study.)
- Articles were written and published in SMH/University newspapers that pointed out some of the issues and concerns with mercury.
- Designated containers for mercury thermometer disposal were placed in the "soiled utility rooms." The containers are marked with a specially designed sticker (see end of this case study).
- Specially designed stickers (see end of this case study) were placed on or near red bag containers to discourage the placement of a mercury thermometer there.
- An overview of the mercury pollution prevention program was given to department heads at a meeting. The overview included the reasons for the program and successes that have been achieved so far.
- A pamphlet on "Mercury Management for Nursing Units" was distributed to the nursing personnel (see end of this case study).
- A plan was developed to display educational materials about mercury for the general public in the corridor to the Hospital cafeteria.



Policy

- Nursing Policy was updated to cover mercury thermometers from isolation units (disinfection prior to collection).
- Policies about mercury have been collected from various departments and are being consolidated.

Best management practices

- A disposal container for mercury-containing electrical parts, such as switches, was placed at the location where the replacement equipment is distributed.
- A protocol for the care, use and recycling of dental materials was implemented in the Department of Dentistry and Eastman Dental Center.
- The Hospital entered into an agreement with the Monroe County Department of Environmental Services that establishes best management practices to reduce mercury loading from the Hospital to the County's wastewater treatment system.

For further information, contact Hazardous Waste Manager, Environmental Health and Safety, University of Rochester, 716-275-2056.



Mercury Survey for Nursing Personnel

This survey is part of an upcoming hospital-wide effort to educate personnel about the proper handling and disposal of mercury-containing items.

A. Which of the following items *may* contain mercury?

1. Gastrointestinal tubes
2. Sphygmomanometers
3. Thermometers
4. Batteries

B. What is the proper disposal method for mercury thermometers in patient care units? Choose one.

1. Place in normal trash.
2. Place in red bag.
3. Send home with patient.
4. Place in soiled utility collection area.
5. Place in sharps shelter.
6. Do not know.

C. Do you know why mercury thermometers should be discarded in this manner (see question above)? Choose all that apply.

1. It prevents mercury from getting into the air during incineration.
2. It prevents mercury from causing an explosion.
3. It prevents mercury from reacting with other hospital chemicals.
4. It ensures proper disposal of mercury.
5. It prevents the spread of disease.
6. All of the above.

D. What is the proper disposal method for a mercury thermometer that has been used in an isolation unit? Choose one.

1. Disinfect before removing from the isolation unit and place in normal trash.
2. Place in red bag.
3. Send home with patient.
4. Disinfect before removing from the isolation unit and place in soiled utility collection area.
5. Place in sharps shelter.
6. Do not know.



E. What is the problem with sending mercury thermometers home with new mothers?

Choose all that apply.

1. The thermometer can cause a health problem in the baby during normal use.
2. The thermometers are very expensive.
3. The family may be exposed to mercury if the thermometer breaks.
4. The thermometer may not be properly discarded.
5. Do not know.

F. What is the protocol for disposal of gastrointestinal tubes containing mercury?

Choose one.

1. Place in a sealed labeled container and place in the soiled utility collection area for pickup by Materials Management personnel.
2. Place in a sealed labeled container and then in the normal trash.
3. Place in a sealed labeled container and call the Hazardous Waste Management Unit for pickup.
4. Do not know.

G. Which of the following health effects is associated with chronic exposure to mercury vapor?

Choose one.

1. Cardiac arrest
2. Lung cancer
3. Damage to the nervous system
4. Allergies
5. Do not know

H. Why is it important to keep mercury out of the air and water? Choose all that apply.

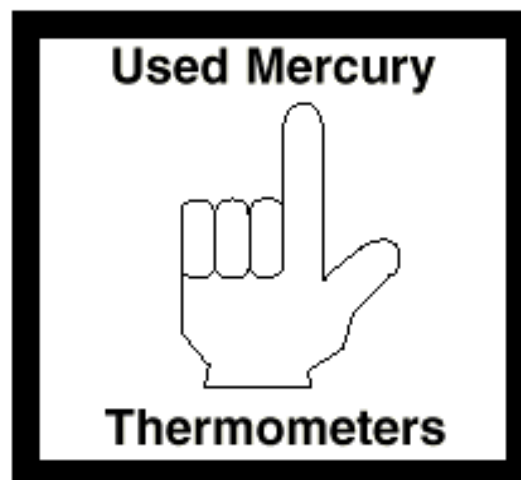
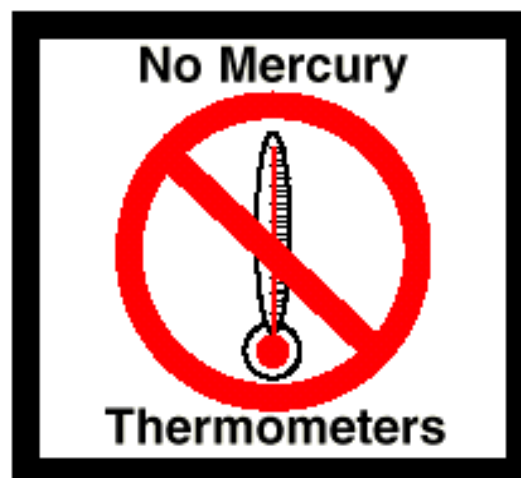
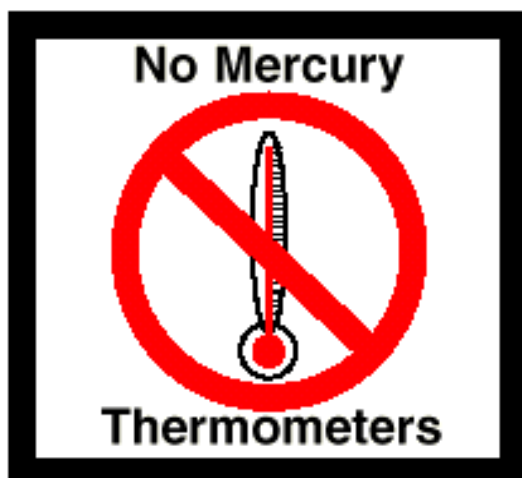
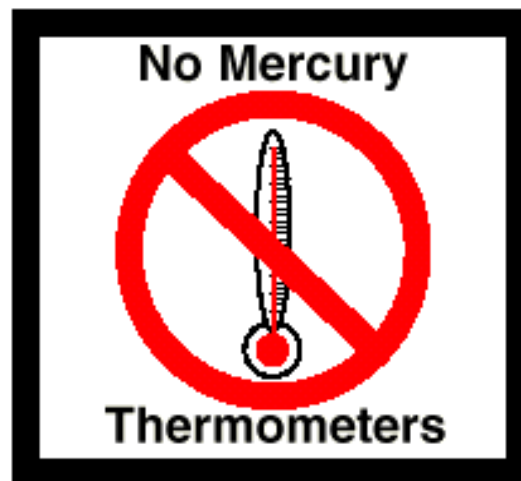
1. It causes human health problems.
2. It bonds easily with other metals.
3. It can damage fish and wildlife.
4. It can be explosive when exposed to sunlight.
5. Its discharge is illegal.
6. Do not know.

I. Who can you always call in the event of an emergency?

What is the telephone number? _____



Mercury Stickers



Steps to Pollution Prevention

**AVOID UNNECESSARY USE OF
HAZARDOUS MATERIALS.**

IF USE IS NECESSARY:

- Use sparingly and carefully.
- Dispose of used and unused products in accordance with facility disposal requirements.
- Clean up spills properly. Follow institutional protocols.

For More Information

**CONTACT THE HAZARDOUS
WASTE MANAGEMENT UNIT
AT:**

x 52056

**IN AN EMERGENCY
CONTACT SECURITY AT:**

x 13

Mercury Management FOR

Patient Care Units

AT

**Strong
Memorial
Hospital**



STRONG HEALTH
STRONG MEMORIAL HOSPITAL

Mercury Pamphlet



Disposal of mercury for nurses

THERMOMETERS

- Place on soiled utility cart. (If from an "isolation" patient, clean with disinfectant first.)



GASTROINTESTINAL TUBES

- Place on soiled utility cart.

BATTERIES

- Place on soiled utility cart.

SPHYGMOMANOMETERS

- Call Medical Engineering Lab for disposal.

Mercury facts

1. Mercury can cause health problems. High levels of mercury in infants can cause nervous system damage and other problems.
2. Mercury bioaccumulates in the body. Mercury builds up in muscles of humans, fish and other wildlife.
3. Mercury gets into the air during incineration or autoclaving of red bags.
4. Improper disposal of mercury is illegal.

In case of a chemical spill...

- Follow nursing procedures and policy manual guidelines 12.10.
- Contact your supervisor.
- Dispose of properly.

never dispose in:
normal trash,
sharp shelters or
red bags.



2. F.F. Thompson Hospital, Canandaigua, New York

F.F. Thompson Hospital has not had a *formal* mercury pollution prevention policy, has not had a *formal* educational program, and has not had a mercury pollution prevention “champion.” And yet Thompson has eliminated almost all uses of mercury from the facility. Thompson began its informal mercury pollution prevention program in 1990 because of the recognition that mercury products can be hazardous to employees and patients, especially where there is a high potential for breakage. Other incentives were the reduction of mercury disposal costs, the avoidance of mercury spill clean-ups, and the difficulty of complying with OSHA requirements for the use of mercury.

The pollution prevention program began with the phase-out of sphygmomanometers, which was completed in 1993. The Hospital has also:

- Discontinued the use of mercury thermometers, except in isolation units, because the electronic thermometers were considered to be a better technology overall.
- Discontinued the use of mercury stains in order to eliminate discharge of the stains to wastewater.
- Replaced or are replacing mercury gastrointestinal tubes with tungsten tubes.
- Eliminated the use of mercury batteries because newer equipment came with mercury-free batteries.

There are some factors that eased Thompson’s transition to mercury-free. Thompson Hospital empowers its associates to make decisions, thus hastening the time to move a project from the idea phase to the implementation phase. Thompson Hospital is a relatively new facility. Therefore, it has been easy to ensure that electrical equipment, such as switches and thermostats, are mercury-free. Thompson’s small to medium size may be an advantage over a larger hospital. It is easier to make changes in a smaller hospital because it has a smaller inventory. Also, a smaller hospital may use a smaller variety of materials.

For further information, contact Mike Zanghi, F.F. Thompson Hospital, 716-396-6770.



3. Case Studies of Mercury Pollution Prevention Measures in Michigan Health Care Institutions

The following information is adapted from: Michigan Mercury Pollution Prevention Task Force (1996), *Mercury Pollution Prevention in Michigan: Summary of Current Efforts and Recommendations for Future Activities*.

As part of the compilation of the *Mercury Pollution Prevention in Michigan* report, a health care group was formed to identify the uses of mercury in hospitals and alternatives for those uses. Several hospitals were contacted regarding the topic of mercury pollution prevention measures currently underway in their institutions. While there are measures that must be adhered to under federal and state laws, for example training on spill prevention and management, many of these health care institutions go beyond mere compliance with existing law by educating a broad spectrum of employees in the proper procedures in handling mercury spills and minimization of mercury use. The following are examples of some of the ongoing activities.

Bronson Hospital, Kalamazoo, Michigan

Educating the staff about the proper use of mercury-containing devices and spill clean-up procedures has helped to decrease mercury in water discharge. Bronson Hospital formalized a policy to ban the purchase of mercury-containing items where alternatives exist. In areas undergoing remodeling, sphygmomanometers containing mercury are being replaced with aneroid devices.

Bronson is also working in conjunction with Kalamazoo's wastewater department to meet their mercury discharge limit of 5 parts per billion, and to further decrease their concentration to 3 parts per billion.

Butterworth Hospital, Grand Rapids, Michigan

Butterworth Hospital has made a commitment to reach mercury-free status. They have instituted a purchasing department policy stating that, unless there is no suitable mercury-free alternative, no mercury-containing devices are to be purchased. Administrative approval was given to replace all sphygmomanometers currently in use with aneroid devices. The obstetrics department stopped sending mercury thermometers home with new mothers.

Butterworth Hospital hired a local environmental consultant to devise a mercury spill response and disposal plan that is safe and economical for the entire hospital. The consultant also offered training on spill response, prevention and management. Educational materials about mercury, including the Terrene brochure (see *Appendix J*), were distributed to all hospital departments, administrative personnel and regional facilities.

Butterworth Hospital is introducing mercury pollution prevention in all entities in the Butterworth health system, such as free-standing medical centers, clinics, nursing homes and affiliated rural hospitals.



Coming Clinical Laboratory (now Quest Diagnostics), Wyoming, Michigan

Coming Clinical Laboratory instituted mercury pollution prevention measures to meet the City's strict water guidelines of 0.5 ppb. Coming isolated manufacturer contributions of mercury within its wastewater system by testing its list of reagents for mercury content. Manufacturers might not list mercury on their Material Safety Data Sheets if the amount is less than one percent. Therefore Coming did not know the sources of mercury until test results were finalized. Once the sources were determined, a formal mercury reduction policy was instituted. Coming located vendors that could provide mercury-free reagents or, where possible, changed methodologies to processes that do not involve mercury.

The following is a list of the top nine mercury-containing reagents discovered at Coming Clinical Laboratory. It should be noted that the survey of these reagents occurred over time and the manufacturers may have reduced their mercury content since the original testing:

- Prostatic specific antigen (Hybertech)
- Cryptococcus antigen wash (Meridian)
- Clostridium difficile wash (Meridian)
- Cesium diluent for lithiums (CMS)
- Wash solution for Hitachi analyzers (BMC)
- FTA antibody test kit (Zeus)
- Lyme antibody test kit (Mardx)
- EBV antibody test kit (Organon)
- Herpes antibody test kit (Biowhittak)

Riverside Osteopathic Hospital, Trenton, Michigan

Riverside Osteopathic Hospital's Mercury Minimization Plan includes identifying sources of mercury, developing a spill management procedure, providing educational material to staff, and developing an action plan that sets up a timetable for implementing mercury pollution prevention measures.

Riverside Hospital identified some mercury sources and found mercury-free alternatives. Riverside informally instituted a policy allowing only mercury-free devices to be used in the Hospital, including thermometers, thermostats and sphygmomanometers. The Hospital discontinued using mercury-containing batteries, and has substituted water-containing esophageal dilator tubes for the mercury-containing tubes. Riverside is investing in T-8 lamps with electronic ballasts that contain less mercury than the lamps previously used. The Hospital has also eliminated caustic drain cleaners and switched to the alternative organic oils and compounds that are not as harmful to the environment. A spill prevention kit was purchased for mercury cleanup.



University of Michigan (UM) Health System, Ann Arbor, Michigan

An informal policy exists in the institution allowing only mercury-free items to be purchased. This includes sphygmomanometers, thermometers and batteries. Sphygmomanometers containing mercury have been replaced with aneroid devices, including those in newly acquired physicians' practices and offsite clinics. The same holds true for mercury thermometers, which are being replaced by their digital counterparts in all areas.

Laboratories within the University Hospitals are investigating whether or not laboratory procedures that contain mercury can be substituted by those that are mercury-free. However, laboratories are hesitant to switch procedures where the same effectiveness is not guaranteed. The pharmacy has successfully discontinued using mercury in any items dispensed. The UM Health System has also implemented a fluorescent tube recycling project.

The Terrene brochure (see *Appendix J*) was distributed to individuals within the UM Health System who are responsible for disposing and dispensing mercury-containing items. UM Hospitals utilize a mercury vacuum as appropriate during spill response activities.

For further information about mercury pollution prevention in the Michigan Hospitals, contact Steve Kratzer, Michigan Department of Environmental Quality, 517-373-0939.



4. Massachusetts Water Resources Authority (MWRA)/Medical, Academic and Scientific Community Organization (MASCO) Mercury Work Group

The Massachusetts Water Resources Authority (MWRA) is a public agency charged with supplying water and sewerage services to municipalities in the Boston metropolitan area. The MWRA/MASCO Mercury Work Group, a public-private partnership of the MWRA and sewer dischargers (including hospitals, universities, and other industries), was established in 1994 to study and implement ways to reduce mercury discharges to the MWRA sewerage system. One institution, the Medical Academic and Scientific Community Organization, Inc. (MASCO) that represents many local Boston hospitals, has worked from the beginning of this effort to help identify the sources and methods of removing mercury from hospital waste streams. Phase II of the Work Group was initiated in 1996 to further examine mercury management techniques and promising mercury pretreatment technologies.

During Phase I, the Work Group addressed sources of mercury, developed a *Mercury Products Database*, considered mercury pretreatment systems, and developed guidelines for source reduction and removal of residual mercury from hospital wastewater piping systems. As a result of this effort, 28 participating hospitals reduced the annual mercury concentration of their wastewater from an overall average of approximately 23 $\mu\text{g/l}$ (ppb) to as low as 6 $\mu\text{g/l}$ (ppb).

The Phase II effort has updated the work of Phase I and has resulted in the development of an enhanced *Mercury Products Database* built on a Microsoft Access™ platform. The Database lists approximately 8,000 chemicals used by hospitals and institutions. For about 800 listed products, the Database includes the results of analytical testing for mercury content. The Phase II effort also resulted in the publication of four reports as follows:

- *Facilities Loadings Subgroup Report* - estimated sewer discharge loadings of mercury from five types of facilities discharging to the MWRA sewerage system.
- *Pretreatment Guidance Manual* - recommended steps for implementing coordinated source reduction, source segregation, and pretreatment including mercury pretreatment.
- *Technology Identification Subgroup Report* - background and results of a bench-scale feasibility testing project involving six different mercury pretreatment technologies.
- *Mercury Management Guidebook* - recommended steps for overall management of mercury to reduce and control the mercury concentration of sewer discharges.

For further information, contact Karen Rondeau, Massachusetts Water Resources Authority, 617-241-2347.



5. Mercury Management at Mayo Clinic

The following case study was written by David H. Senjem, Environmental Safety Coordinator, Mayo Clinic, Rochester, Minnesota.

Mayo's management of mercury in the medical environment has evolved over time. Mercury batteries were first collected for referral to a California-based reprocessing center in 1978. A strong emphasis has existed since the mid-1970s on collecting and commercially disposing of mercury-containing laboratory wastes through Mayo's hazardous waste program. Specialized mercury vacuum cleaners were first purchased in the 1970s to ensure that mercury spills were effectively and safely managed.

In more recent years, institutional interest in mercury management has led to even more aggressive actions. Mercury thermometers have been removed from Mayo's 1,500 outpatient examination rooms and replaced with electronic devices. Mercury-containing sphygmomanometers were replaced with mercury-free devices in all hospital areas. Laboratory test procedures have been re-evaluated for mercury use with an emphasis on substitution, whenever possible, and strict attention to disposal management when not possible. Used mercury-containing fluorescent light bulbs are collected and disposed of through a commercial vendor who recovers and recycles mercury.

Efforts continue to further investigate and reduce the presence of mercury in the Mayo environment. Examples of such efforts include the incorporation of heavy metal analysis in certain product purchases and similar evaluations in certain large components of Mayo's incinerated waste stream. Additionally, there are continuing educational efforts to sensitize staff on avoidance of the use of mercury or mercury-containing materials, whenever possible, and especially when alternative choices are available.

For further information, contact David Senjem, Mayo Clinic, 507-284-7459.

6. St. Mary's Medical Center, Duluth, Minnesota

The following information is from: Western Lake Superior Sanitary District (March 1997), *Blueprint for Mercury Elimination: Mercury Reduction Project Guidance for Wastewater Treatment Plants*, page 18.

St. Mary's Medical Center is a 326-bed hospital located in Duluth, Minnesota. Western Lake Superior Sanitary District (WLSSD) staff began the mercury reduction project by meeting with Hospital management to ensure their interest and commitment. Once support was assured, an existing team of Hospital employees worked with WLSSD staff on the project.

Representatives from maintenance and purchasing departments were particularly important to the team. The maintenance staff is familiar with the inner workings of the Hospital, which is helpful when conducting monitoring. Purchasing department involvement is necessary because toxics reduction projects often involve changes in the types of products purchased and used.

As a first step, the mercury reduction team completed a survey on mercury use provided by WLSSD (see survey at the end of this case study). The survey disclosed that St. Mary's had already replaced some mercury-containing items, such as thermometers and blood pressure cuffs, with alternative electronic devices. In addition, mercuric chloride, a common reagent used in the pathology lab, was being captured and handled as hazardous waste instead of being flushed to the wastewater treatment plant.

A wastewater monitoring plan was then developed to try to pinpoint mercury sources within the Hospital. Older buildings, such as hospitals, often have several discharge points to the sanitary sewer system. Meeting with maintenance staff to review old blueprints was found to be essential before beginning the monitoring program. The use of dye tablets may be needed to verify sewer flow and route connection information, especially in facilities that have undergone expansion. Monitoring results found mercury concentrations varying from 0.3 ppb to 1.2 ppb. The monitoring also identified days on which mercury concentrations were high, and where it came from in the Hospital. In this case, the information was valuable in educating the reduction team. The team felt they had already solved their mercury problem and didn't anticipate additional discharges. Once they saw the numbers, however, a "can do" attitude quickly developed.

In 1997, the remaining mercury in the wastewater appeared to be coming from the Hospital laboratories and laundry services. Reagents and bleach are the suspected sources. These products are being investigated and, where possible, alternatives will be substituted.

Historic sources are also under investigation. Mercury from items such as broken thermometers may have been disposed of down the drain in older buildings. The mercury accumulates in waste traps and discharges in small amounts each time water is used. Traps in nursing stations and in the labs are being cleaned and inventoried as part of the reduction effort.



WLSSD continues to work with St. Mary's on mercury reduction and has initiated similar projects with the other hospitals in Duluth. These following actions are essential first steps for any hospital beginning a mercury reduction project:

1. Discontinue the purchase of mercury-containing equipment such as thermometers, sphygmomanometers and gastrointestinal equipment, and substitute mercury-free alternatives for existing equipment.
2. Discontinue the policy of sending mercury thermometers home with new parents (this practice is illegal in Minnesota).
3. Institute recycling programs for mercury-containing lamps and batteries.
4. Implement a mercury-free purchasing policy and request all vendors to disclose mercury concentration on a Certificate of Analysis. Products with no mercury or low mercury can then be selected for purchase.

For further information, contact Jamie Harvie, Western Lake Superior Sanitary District, 218-722-3336, ext. 307.



WESTERN LAKES SUPERIOR SANITARY DISTRICT MEDICAL FACILITY MERCURY SURVEY

This checklist is provided as a sample. A checklist can be a useful tool to help medical facility staff identify sources of mercury in their workplace.

Type of Facility (hospital, clinic) _____
 Size of Facility (number of beds, number of patient visits) _____
 Contact Name _____
 Title _____ Phone _____

MERCURY SOURCES

Please indicate the following mercury sources located or used in your facility.

- ☐ Fever thermometers (including home-care visits and those sent home with newborns)
- ☐ Sphygmomanometers
- ☐ Commercial manometer
- ☐ Gastrointestinal diagnostic equipment
- ☐ Feeding tubes

Chemicals

- ☐ Zenker's solution ☐ Histological fixatives

Staining solution and preservatives

- ☐ Mercury chloride ☐ Mercury (II) oxide ☐ Mercury (II) chloride ☐ Mercury (II) sulfate
- ☐ Mercury nitrate ☐ Mercury iodide ☐ Other

Lamps

- ☐ Fluorescent ☐ Metal halid ☐ High pressure sodium ☐ Ultraviolet

Batteries

- ☐ Mercuric oxide ☐ Button batteries

☐ Thermostats

☐ Barometers

☐ Switches (relay, tilt, silent)

☐ Other possible mercury sources -- please list here any other materials that should be a concern for mercury pollution.

Have you considered mercury-free alternatives for any of the products listed above? ☐ Yes ☐ No



FACILITY PRACTICES

Complete the following section on facility practices. Additional pages may be attached if needed.

Safety Practices

Is staff training provided on the health and environmental concerns of mercury? ☐ Yes ☐ No

Is staff training provided on mercury spill prevention or management? ☐ Yes ☐ No

If yes, indicate the departments that have this training and the frequency.

Is there a mercury spill clean-up kit on site? ☐ Yes ☐ No

Have there been any mercury spills within the last ten years? ☐ Yes ☐ No

If yes, indicate the source of the spill(s) and the clean-up method.

Purchasing Practices

Does your facility have a policy on purchasing mercury-containing products? ☐ Yes ☐ No

If yes, please attach policy.

Does your purchasing department currently require a disclosure by your vendors of mercury concentrations in chemicals/reagents? ☐ Yes ☐ No

Disposal Practices

What is the current procedure for disposal of medical waste?

☐ autoclave ☐ incineration ☐ other

Have your sewer drain traps or catch basins been cleaned to remove mercury? ☐ Yes ☐ No

If yes, list the area of the facility and dates.

Was mercury discovered? ☐ Yes ☐ No

Are any mercury products in your facility currently recycled? ☐ Yes ☐ No

Are there other facility practices that you think should be a concern for mercury pollution? List here:



Appendix M

Prevent Mercury Pollution

Use Best Management
Practices for Amalgam
Handling and Recycling





John D. Doyle
County Executive



Prepared by the Monroe County Department of Health, in cooperation with
the University of Rochester's Department of Dentistry and Eastman Dental Center and
the Monroe County Department of Environmental Services,
with funding by a grant from the U.S. Environmental Protection Agency



Introduction



This booklet has been developed to enlist your help in a region-wide effort to manage amalgam waste so as to protect the environment from mercury. The amalgam management practices described in this booklet were developed during the past few years by dentists at the University of Rochester's Department of Dentistry and Eastman Dental Center in Rochester, New York, and by dentists in Minnesota, in cooperation with the Western Lake Superior Sanitary District. The methods have been shown to be effective in keeping mercury from amalgam out of the environment.

Share this booklet with your staff. When new employees join your staff, make sure that they read this booklet also. You and your staff together can evaluate your current practices and, where appropriate, adopt new practices to protect the environment from the discharge of mercury from dental amalgam.

How mercury from dental amalgam can get into the environment

There are many ways that mercury from dental amalgam can get into the environment:

- Amalgam particles that are rinsed down drains or that escape poorly maintained chair-side traps and vacuum pump filters travel through the sewer system to the wastewater treatment plant. From there mercury from the amalgam may enter the environment in one of three ways: (1) It may be released directly to a waterway; (2) It may be released to the air if the treatment plant sludge is incinerated and then re-deposited to the ground or a waterway; (3) It may be released to soil if treatment plant sludge is land spread.
- If a dental practice is connected to a septic system, amalgam particles become part of the sludge in the septic tank, which is eventually pumped out and transported to a wastewater treatment plant or land spread. Any mercury from the amalgam that becomes soluble will end up in groundwater.
- Placing an item that contains amalgam particles in a red bag allows mercury from the amalgam to be released into the air if the medical waste is incinerated. The volatilized mercury is then re-deposited to the ground or a waterway.
- If items that contain amalgam particles are discarded with the ordinary trash, there is the potential for mercury from the amalgam to leach into groundwater when the trash is placed in a landfill not designed to handle hazardous waste.
- In an older dental clinic, pure bulk mercury from past practices may have settled in sink traps. The mercury is gradually released into wastewater for many years after the use of bulk mercury has been discontinued.

New federal regulations greatly reduce the amount of mercury that is allowed to be discharged from a municipal wastewater system or an incinerator. By implementing the best management practices described in this booklet, you can reduce the level of mercury in the environment and avoid the need for increased regulations in the years to come.

Amalgam storage and handling

Stock your amalgam materials in a good choice of capsule sizes, in order to better select the right amount of material for a particular restoration. This will minimize waste.

Dental scrap amalgam should be collected and stored in two designated, tightly closed, widemouth plastic containers. One container should be labeled CONTACT AMALGAM (amalgam that has been in the patient's mouth). The other should be labeled NONCONTACT AMALGAM. Neither the New York State Department of Health nor the Occupational Safety and Health Administration (OSHA) requires that contact amalgam be discarded in a medical waste red bag.

Most recyclers prefer that *contact* amalgam be transported for recycling in a disinfectant. The liquid is visual evidence that the contact amalgam has been disinfected. *Noncontact* amalgam in a tightly sealed container can be stored and transported dry.

Amalgam capsule handling

Collect and store the entire contents of broken or unusable capsules with your noncontact scrap amalgam. If empty dental amalgam capsules contain no visible amalgam materials, they may be placed in the trash.

If there is a spill of mercury from a capsule, contain it and clean it up immediately. Keep mercury clean-up materials on hand, and train a staff member in proper spill clean-up. Inexpensive mercury clean-up materials are available from science and safety equipment suppliers. (Some suppliers are listed on page 8.)

Amalgam trap and filter handling

When the fine particles of amalgam come in contact with cleaning agents and chemicals in the suction system and sewers, the mercury may be released. Large particles of amalgam can be prevented from entering the sewer system by the use of chair-side traps and vacuum pump filters. Material captured in the traps and filters can be sent to a recycler. Calculations based on data in scientific literature indicate that, when used properly, chair-side traps and vacuum pump filters can capture about 70% of the amalgam that enters the vacuum system.



- ✦ **Never rinse scrap amalgam down the drain.**
- ✦ **Never place scrap amalgam in the medical waste red bag.**
- ✦ **Never place scrap amalgam in the trash.**

Recommended techniques for collecting amalgam from the chair-side traps are as follows:

1. Change or clean chair-side amalgam traps often. The frequency may vary from daily to weekly depending on how often the chair is used for amalgam placement or removal and the effectiveness of the suction.
2. Flush the vacuum system with disinfecting line solution before changing the chair-side trap. The best method is to flush the line at the end of the day, and then change the trap the first thing the next morning.
3. Use universal precautions (gloves, glasses and mask) when handling the chair-side trap. Choose utility gloves intended for cleaning and handling wastes for this procedure.
4. Do not place gloves, plastic bags or paper towels into the recycling container. These add to the volume of the waste created and cause problems in the recycling equipment.
5. Remove all visible amalgam by tapping the contents into the container labeled CONTACT AMALGAM. Close the cover tightly. If the trap is visually clean, it can be put in the trash. These visually clean traps have been determined to be nonhazardous.* (A heavily contaminated trap should always be recycled. It should be placed in the contact amalgam container.)



Vacuum pump filters are usually located upstream of the central vacuum pump. Recommended techniques for recycling the vacuum pump filters are as follows:

1. Replace or dispose of these filters regularly as recommended by the equipment manufacturer.
2. Use universal precautions.
3. Remove the filter and decant, over a tray, as much liquid as possible without losing visible amalgam.
4. Put the lid on the filter and place the filter in the box in which it was originally shipped. When the box is full, the filters should be recycled.



*Shown by the Toxicity Characteristic Leaching Procedure (TCLP) to be acceptable for landfilling.

Plumbing replacement and repairs

After your office adopts its new amalgam management practices, it may be a good time to replace sink traps. Mercury from past practices often settles at low points such as sink traps and sumps. The slow dissolution of the mercury in a sink trap or sump can release mercury into the wastewater for years after past disposal practices have been corrected. Whenever plumbing parts are moved or cleaned, caution should be taken to avoid spilling the contents in case amalgam or mercury are present. Pour and brush out the sludge and handle it as you would handle contact amalgam. The plumbing parts can be put back in place or discarded in the trash.

Renovations

If you have an older dental office, alert renovators to the possibility of mercury contamination in carpets, in floor cracks, behind moldings and other areas where bulk mercury may have been used, or where amalgam capsules may have been spilled. Call your county health department, district office of the New York State Department of Health, or regional office of the New York State Department of Environmental Conservation if you have questions about disposal of renovation debris. (See page 7 for telephone numbers.)

Keep informed on separator technologies

Systems are available to treat wastewater contaminated with amalgam particles that are too fine to be caught in traps or filters. Most systems employ centrifugation or enhance sedimentation of particles. Some can also capture mercury that is in solution. Some of the new equipment can remove more than 99% of the mercury in the wastewater. It is used in some European countries, where removal rates of at least 95% are required. The systems are being evaluated in dental offices in the U.S. Equipment can be purchased or leased. These systems are expensive now, but may become cheaper in the future. Contact 716-292-3935 for further information.

Recycle bulk elemental mercury stock

In 1994 the American Dental Association recommended that dentists eliminate the use of bulk dental mercury by switching to precapsulated amalgam alloy in their practices. Measurement of the ratio of liquid mercury to amalgam powder is much more exact with the precapsulated technique. There is also less possibility of leakage during trituration. The use of precapsulated amalgam alloy eliminates mercury dispensers and containers as sources of mercury vapor, and eliminates the possibility of spilling a large quantity of mercury.

Recycle bulk mercury. If there is a spill of a large amount of bulk mercury before it is eliminated from your office, call your county health department or district office of the New York State Department of Health for instructions about cleaning it up. (See page 7 for telephone numbers.)

➡ Recycle any bulk elemental mercury that may still be on hand in your office.



Select a recycling method

There are four options for recycling the amalgam from your dental office.

1. **Amalgam containers only:** Mail via U.S. Mail to the Monroe County Household Hazardous Waste Facility in Rochester. It has authorization to collect noncontact amalgam and contact amalgam by mail from other counties, as well as from Monroe County. Make arrangements with the Monroe County Household Hazardous Waste Facility at 716-760-7600 to receive detailed instructions for amalgam recycling. Packaging materials will be provided for your office as long as supplies last.
2. **Amalgam containers, vacuum pump filters and bulk mercury:** Deliver directly to the Monroe County Household Hazardous Waste Facility in Rochester. Materials can be dropped off without an appointment in the Industrial Waste Office foyer of Building 15 at 444 East Henrietta Road, in Rochester. The foyer is open between 7:00 a.m. and 4:30 p.m. Monday through Friday. The Facility has authorization to accept deliveries of these materials from other counties, as well as from Monroe County. Call 716-760-7600 for directions to the Facility and other information.
3. **Amalgam containers and vacuum pump filters:** Ask your infectious or hazardous waste hauler if delivery of amalgam containers and vacuum pump filters to a mercury recycler or the Monroe County Household Hazardous Waste Facility can be arranged.
4. **Amalgam containers, vacuum pump filters and bulk mercury:** Work directly with an amalgam recycling company. There are many questions you will need to ask when choosing a recycler:
 - What can I recycle?
 - Contact amalgam
 - Noncontact amalgam
 - Chair-side traps
 - Vacuum pump filters
 - Bulk mercury
 - What are the costs or profits for recycling each of the above?
 - What are the instructions for disinfection of contact amalgam?
 - What are the packaging requirements for contact amalgam, noncontact amalgam chair-side traps, vacuum pump filters and bulk mercury?



(See page 6 for a partial list of recyclers.)

Recycling Companies

Advanced Environmental Recycling Co.
2591 Mitchell Ave.
Allentown, PA 18103
800-554-AERC

Amalgaway Mail Disposal Service
1002 West Troy Ave.
Indianapolis, IN 46225
800-267-1467

Bethlehem Resource Recovery Division
890 Front St.
P.O. Box Y
Hellertown, PA 18055
610-838-7034

Dental Recycling North America, Inc.
P.O. Box 1069
Hackensack, NJ 07601
800-525-3793

DFG Mercury Corp.
909 Pitner Ave.
Evanston, IL 60202
847-869-7800

Dorell Refinery
533 Atlantic Ave.
Freeport, NY 11520
800-645-2794

Everlights
8500 West 191st Street, Suite 1
Mokena, IL 60448
815-469-0631

Garfield Refining
810 East Cayuga
Philadelphia, PA 19124-3892
800-523-0968 ext. 300

Global Recycling Technologies, Inc.
218 Canton St.
Stoughton, MA 02072
781-341-6080

Maquire & Strickland Refining Co.
1290 81st Ave. NE
Minneapolis, MN 55432
612-786-2858

Mercury Refining Company, Inc.
1218 Central Ave.
Albany, NY 12205
800-833-3505

Mercury Waste Solutions, Inc.
21211 Durand Ave.
Union Grove, WI 53182
414-878-2599

RECYCLIGHTS, Inc.
401 West 86th St.
Minneapolis, MN 55420
800-831-2852

Safety Kleen
P.O. Box 97
Avon, NY 14414
716-226-2411

Note: The above list does not imply an endorsement of any company. Each user is responsible for verifying vendor information. The list is not intended to be all-inclusive, but is provided for informational purposes only.



Contacts for Applicable Regulations

NYSDEC, Region 8 (Counties of Genesee,
Livingston, Monroe, Ontario)
Division of Water
6274 East Avon-Lima Road
Avon, NY 14414
716-226-2466

NYSDEC, Region 9 (Counties of Allegany,
Wyoming)
Division of Water
270 Michigan Avenue
Buffalo, NY 14203-2999
716-851-7070

Allegany County
Public Health Director
Allegany County Health Department
County Office Building
Belmont, NY 14813
716-268-9254

Genesee County
NYSDEC Region 8; also contact the
municipality

Livingston County
Environmental Health Director
Livingston County Health Department
2 Livingston County Campus
Mount Morris, NY 14510-1691
716-243-7280

Monroe County
Industrial Waste Control Section
Monroe County Department of
Environmental Services
444 East Henrietta Road
Rochester, NY 14620
716-760-7600

Ontario County
Cornell Cooperative Extension, Ontario
County
480 North Main St.
Canandaigua, NY 14424
716-394-4110

Wyoming County
Public wastewater system:
NYSDEC Region 9
Private wastewater system:
Public Health Engineer
Wyoming County Health Department
338 North Main St.
Warsaw, NY 14569
716-237-2666



Providers of mercury spill clean-up products

Bel-Art Products
Pequannock, NJ 07440-1992
201-694-0500

Fisher Scientific
52 Fadem Road
Springfield, NJ 07081
800-766-7000

Lab Safety Supply, Inc.
P.O. Box 1368
Janesville, WI 53547-1368
800-356-0783

Thomas Scientific
99 High Hill Road @ I-295
P.O. Box 99
Swedesboro, NJ 08085
800-345-2100

VWR Scientific Products
5 Marway Circle
Rochester, NY 14624
716-247-0613
800-932-5000

Note: The provision of these names does not imply an endorsement, nor is it intended to be all-inclusive. Each user is responsible for verifying vendor information. The list is provided for informational purposes only.

Contacts for further information

Monroe County Department of
Environmental Services
716-760-7610, Extension 7055

Monroe County Department of Health
716-292-3935



Summary of Recycling and Disposal Options

Waste Type	Source	Option
Amalgam particles - noncontact	Excess mix, broken or unusable capsules	Send to a recycler.
Amalgam particles - contact*	Chair-side traps	1. Change regularly. 2. Send sludge to a recycler. 3. Discard trap in the trash.
Amalgam particles - contact*	Vacuum pump filters	1. Change regularly. 2. Decant some of the liquid. 3. Put on the lid and recycle in the original shipping carton.
Elemental mercury	Past use of bulk elementary mercury	Manage as hazardous waste; send to a recycler.
Empty amalgam capsules		Discard in the trash.

* Amalgam that has been in the patient's mouth

Appendix N

Mercury Waste Recyclers in the Northeast U.S.

The northeastern U.S. mercury waste recyclers listed below are “full service” recyclers. In general, they will accept the full range of mercury waste from a hospital: thermometers, gastrointestinal tubes, laboratory chemicals, batteries, lamps, relays, switches, thermostats, manometers, metallic mercury, and mercury-contaminated material. They also accept dental amalgam from hospitals that have a dental clinic. See the following pages for a list of fluorescent lamp recyclers.

Specific services vary from company to company. Each user is responsible for verifying vendor information. The list below does not imply an endorsement of any company, and it is not intended to be all-inclusive, but is provided for informational purposes only. In addition to contacting the companies listed, you can ask your current hazardous waste hauler to put you in contact with a mercury recycler.

Advanced Environmental Recycling Co.
2591 Mitchell Ave.
Allentown, PA 18103
800-554-AERC
FAX: 610-797-7696

Global Recycling Technologies
218 Canton St.
Stoughton, MA 02072
781-341-6080
FAX: 781-341-6088

Bethlehem Resource Recovery Division
890 Front St.
P.O. Box Y
Hellertown, PA 18055
610-838-7034

Mercury Refining Company, Inc.
1218 Central Ave.
Albany, NY 12205
800-833-3505
FAX: 518-459-2334



Fluorescent Lamp Recyclers in the Northeast

Advanced Environmental Recycling Corporation
2591 Mitchell Avenue
Allentown, PA 18103
(800) 554-AERC

ALR-American Lamp Recycling, LLC
22 Stage Door Road
Fishkill, NY 12524
(800) 315-6262

Bethlehem Resource Recovery Division
890 Front Street
PO Box Y
Hellertown, PA 18055
(610) 838-7034

Dynex Environmental, Inc.
Customer Service
P.O. Box 1323
Fond du Lac, WI 54936-1323
(800) 932-6216

Envirocycle, Inc.
P.O. Box 5367
High Point, NC 27262
(910) 869-8836

Global Recycling Technologies
218 Canton Street
Stoughton, MA 02072
(781) 341-6080

Light Cycle, Inc.
1222 University Avenue
St. Paul, MN 55104
(612) 641-1309

Mercury Refining Company
1218 Central Avenue
Albany, NY 12205
(800) 833-3505

Northeast Lamp Recycling, Inc.
250 Main Street
East Windsor, CT 06088
(860) 292-1992

Recyclights, Inc.
401 W. 86th Street
Bloomington, MN 55420
(612) 948-0626
(800) 831-2852

Recyclights, Inc.
4220 Perimeter Drive
Columbus, OH 43228
(800) 831-2852
(614) 276-3000

USA Lamp and Ballast Recycling, Inc.
5366 Este Avenue
Cincinnati, OH 45232
(800) 778-6645

Specific services vary from company to company. Each user is responsible for verifying vendor information. The list above does not imply an endorsement of any company, and it is not intended to be all-inclusive, but is provided for informational purposes only. In addition to contacting the companies listed, you can ask your current hazardous waste hauler to put you in contact with a fluorescent lamp recycler. For information on the regulations concerning recycling or disposal of fluorescent lamp bulbs or ballasts, contact the New York State Department of Environmental Conservation at (518) 485-8988.



Appendix O Infrastructure Control Measures

(Information taken from a draft version of the *Mercury Management Guidebook*, now under preparation by the MWRA/MASCO Mercury Work Group, Boston, MA)

[This Appendix cites the current Massachusetts wastewater discharge limit of one part per million which does not apply in New York State. The recommended discharge limit established by the New York State Department of Environmental Conservation for mercury wastewater discharge is: a practical quantifiable limit of 0.8 micrograms per liter (μL) and a method detection limit of $0.2\mu\text{L}$.]

The MWRA/MASCO Mercury Work Group, a public-private partnership of the Massachusetts Water Resources Authority (MWRA) and sewer dischargers (including hospitals, universities, and other industries), was established in 1994 to study and implement ways to reduce mercury discharges to the MWRA sewerage system. One institution, the Medical Academic and Scientific Community Organization, Inc. (MASCO) that represents many local Boston hospitals, has worked from the beginning of this effort to help identify the sources and methods of removing mercury from hospital waste streams.

One area studied by the MWRA/MASCO Mercury Work Group was the waste piping infrastructure of a facility because elemental mercury waste deposits and mercury-contaminated bacteriological growth (biomass) were identified as possibly significant contributors to chronic mercury contamination in wastewater discharges. Some of the accumulated mercury could be biologically converted to methyl mercury which is both soluble and highly toxic. In addition, research by several hospital institutions found that the biomass within their "Special Waste" plumbing systems would readily absorb and accumulate mercury, with concentrations reaching as high as 1,000 mg/kg (ppm). Fragments of biomass were seen to periodically break off and carry the absorbed, concentrated mercury to the sewer discharge. Because of these concerns, the Work Group developed in its Mercury Management Guidebook a section called Infrastructure Control Measures to assist facilities that experience mercury-contaminated biomass within their waste piping infrastructure.

Infrastructure control measures may include the following steps:

- source reduction
- source segregation, waste piping modifications
- waste trap sampling, cleaning, or replacement
- waste piping cleaning or replacement
- wastewater collection for offsite disposal
- wastewater pretreatment (possibly consisting of solids sedimentation, multistage filtration, or other process steps).

While these steps are listed in a possible chronological order, the actual number and order of steps could be different depending upon the facility and its action plan.



The guidelines and procedures that follow are meant to focus on mercury and biomass removal from piping systems that carry Special Waste (as defined in the Massachusetts State Plumbing Code). However, the guidelines and procedures can be followed by any facility where discharge of mercury-containing materials to waste piping systems has been confirmed or is suspected. The guidelines and procedures are Waste Piping Design Guidelines, Trap Cleaning Procedures, and Power Washing Procedures.

Before any of these guidelines and procedures are considered, however, a facility should learn if elemental mercury or mercury-containing compounds will continue to be disposed to drains within the facility. Continued disposal of any amount of mercury to drains may mean that the waste trap and piping cleaning procedures would be totally ineffective or effective only for a short period after which they would have to be repeated.

In addition, power washing of waste piping systems cannot be recommended without reservation because of the difficulties in reaching all required sections of the system, uncertainties in the ability of power washing to effectively remove all biomass residues thereby exposing new surfaces from which mercury can reach the wastewater, and evidence that power washing may actually lead to new mercury violations. If a facility chooses to engage in power washing, collection and offsite disposal of the affected wastewater or removal of dislodged biomass particles from the wastewater may be needed for some period to avoid further compliance problems.

For its permitted dischargers, the MWRA will require prior notice of intended power washing. In addition, the MWRA is considering additional requirements such as approval of power washing protocols and collection and offsite disposal of the facility wastewater during and after power washing until sampling and analyses show that mercury concentrations in the discharge have returned to the same levels or lower that existed before the power wash procedure. Because dislodged solids could appear at the permitted sampling location for some time after power washing, a temporary or permanent sedimentation and multistage filtration system within the piping system or at the final discharge point could be considered separately or as part of a mercury pretreatment system. The proposed installation of a filtration system must be disclosed to the MWRA, however, since the MWRA will likely consider the filtration system to be a type of pretreatment system.

For reference and clarification, Massachusetts Special Waste is defined below and the concepts of biomass growth and mercury accumulation and concentration are discussed.

Special Waste

According to Massachusetts regulations (248 CMR 2.13, a part of the State Plumbing Code), “Special Waste” includes, but is not limited to, chemicals, nuclear, radioactive, acids, alkalis, perchloric solvents, organisms containing recombinant DNA molecules, and other similar non-domestic wastes from various laboratories and industrial activities. These types of wastes are potentially detrimental to a public sewerage system and often do not comply with limitations established by the local Publicly Owned Treatment Works (POTW) such as the MWRA.



According to the State Plumbing Code, all Special Waste must be conveyed within facilities in a separate, dedicated waste and vent piping system. The design, methods, materials, types of waste neutralization systems, testing, and inspections required for Special Waste piping systems are governed by the Code. Allowed materials and installation methods for Special Waste piping systems are also specified. The Code does not specify, however, the manner by which Special Waste piping systems are to be used after installation or what specific chemicals may be disposed into the system on a daily basis. On the other hand, the Code does prohibit the introduction of solvent-bearing waste¹ and requires the facility owner to submit a notarized letter stating what chemicals will be discharged into the Special Waste system.² The letter will be part of the basis of the design of the system by a Registered Professional Engineer. In addition, the Code states that wastewater treatment systems shall be part of the Engineer's design when needed for compliance with regulatory limits.³

All proposed Special Waste piping and pretreatment system installations, modifications, revisions and additions must be detailed in engineering drawings and specifications and certified by the Engineer. The drawings and specifications must be submitted to the local Plumbing Inspector for review and approval before construction. The approved documents are then submitted to the responsible jurisdictional authority (e.g., the MWRA or the DEP) with the proper permitting documents and supporting engineering design data for final approval before the Special Wastes can be discharged to the sewerage system.⁴

Biomass Formation and Mercury Accumulation

Biomass growth in Special Waste piping systems is enhanced by the presence of organic matter such as blood products, urea, soaps, chemical reagents, and infectious wastes discharged into the piping system. The combination of these organic substances, temperature, and humidity provides a good environment for biomass growth on the interior surfaces of the waste piping. The organic matter often contains methyl and dimethyl groups that can be combined by certain bacteria with inorganic mercury in the wastewater to create very toxic organic forms of mercury (e.g., methyl mercury). In addition, the mercury accumulates in the biomass and concentrates to significant levels. Because of this phenomenon of "bioconcentration," biomass mercury concentrations of 1,000 mg/kg (ppm) have been reported.

Within a flowing pipe, the biomass growth occurs principally below the liquid level with lesser amounts above. Within a trap at a sink or elsewhere, the growth can be more pronounced because of lower flows that create a continuous liquid "incubator" where there is no oxidation or dehydration of the bacteria. A hardened skeleton of carbon, oxidized soap products containing elements such as calcium and potassium, and dried blood products can be formed that strongly adheres to the piping surface.

When there is wastewater flow, "slugs" of mercury-laden biomass may be carried into the wastewater stream when pieces of the accumulated growth are dislodged from the piping wall. Therefore,

¹ Massachusetts regulations 248 CMR 2.13 (8)(e).

² Massachusetts regulations 248 CMR 2.13 (4).

³ Massachusetts regulations 248 CMR 2.13 (10).

⁴ For further information, refer to the MWRA/MASCO Mercury Work Group, *Pretreatment Guidance Manual*, December 1997.



large amounts of biomass growth can lead to instances of high mercury concentrations in discharged wastewater. To move toward compliance with mercury discharge limits, therefore, this phenomenon may have to be addressed in facilities that have mercury-contaminated biomass growth. The following guidelines and procedures may help some facilities to properly address the issue.

It should be noted that biomass formation can also occur within wastewater neutralization tanks thereby increasing the potential for further mercury accumulation. As allowed by the Massachusetts State Plumbing Code⁵, limestone chips are often used in sumps or tanks (i.e., chip tanks) for neutralization of Special Wastes containing dilute acids and alkalis. Chip tanks cannot be used in facilities discharging significant quantities of organic materials, however, since biomass growth will coat the surfaces of the limestone chips, rendering them useless for neutralization. It is recommended, therefore, that facilities check the condition and efficacy of any chip tanks and replace them with active (adjustable) neutralization systems as appropriate.

WASTE PIPING DESIGN GUIDELINES

Facility Infrastructure Inspection

The first step in dealing with known mercury contamination in the waste piping infrastructure of a facility is to conduct an audit of the existing piping systems. Drawings that reflect details of the actual waste piping, vent piping, and any associated pretreatment system installations should be prepared. Special Waste riser diagrams are important tools and can show regulating authorities that the facility has knowledge and control of all Special Waste discharges. These diagrams should display all isolation valves, glass inspection ports or sections, and sampling/drain valves. The diagrams should also show any current areas lacking control or isolation of Special Waste discharges.

Piping System Design and Modification

After the piping system audit, the facility may determine that modifications are necessary to allow for isolation of waste streams, cleaning, sampling, testing, and monitoring. System designs or modifications should take into account:

- The type of wastes being discharged and the piping material compatibility.
- The future uses of laboratory spaces (i.e., a chemical research laboratory that is to be changed to a blood testing laboratory).
- The need to isolate branch piping from waste and vent stacks to allow pipe cleaning (if needed and selected) without constricting waste flows from other areas or causing overflows to uncontaminated piping systems.
- The investigation of unidentified Special Waste sources and associated piping for biomass and mercury content before combining with previously identified Special Waste piping. Pending the results of investigation of these new sources, additional isolation valving and/or new dedicated risers discharging to the neutralization system may need to be installed.

For trap cleaning and power washing procedures as discussed below, the types of sanitizing and cleaning agents proposed for use must be reviewed in relation to possible interactions with the



chemicals that may be contained in the waste piping system. The potential for incompatible reactions should be considered to ensure that trap cleaning and power washing procedures will not create any unsafe conditions. Reactions that may cause fuming and gas evolution into the working environment, and into the piping system, must be avoided.

Isolation Valves

The facility may determine that isolation valves need to be installed to allow for trap cleaning, removal of noncompliant wastes, sampling of suspect branch piping, and control of potential cross-contamination. The location of isolation valves should consider accessibility and maintenance especially when co-fitted with a sampling port for testing.

The location of valves should not cause an overflow of noncompliant wastes into another area where a spill may occur. As an example, a floor drain would overflow if too much liquid used for pipe cleaning was poured into a counter top sink at a higher elevation. Additionally, the need to provide isolation valves in the venting system must not be overlooked for the same reasons.

Sampling Ports

Sampling ports should be installed in strategic locations for the periodic collection of samples of wastewater for monitoring purposes. Design of the sampling ports can follow that shown in Figure 2, Recommended Sampling Port for Special Wastes, of the *Pretreatment Guidance Manual*.⁶

A sampling port in an isolated branch of piping may not only act as a monitoring point but also as a drain leg for any sanitizing or cleaning agents used. The sampling port nozzle may be replaced with a full-size drain leg for transfer of suspected noncompliant cleaning wastes to containers for off-site disposal.

Special Waste Riser

Vertical Special Waste and vent piping risers may need to be isolated to allow for sequential cleaning, sanitizing, and testing of portions of entire systems in the same manner as has been explained for horizontal runs of piping. During these periods, special consideration must be given to the isolation of vent piping to reduce the possibility of overflow of reagents back through the piping system.

Glass Inspection Ports

Inspection ports or a section of clear borosilicate glass piping should be installed within the main horizontal run of the Special Waste conveyance system employing thermoplastic or other opaque piping materials so that flow conditions can be viewed and the biomass accumulation can be periodically observed. If any branch piping may contain undiluted hydrofluoric acid, however, this piping should be routed separately and connected downstream of the glass fitting and should have its own isolation valve and sampling port assembly.

⁶ MWRA/MASCO Mercury Work Group, December 1997.

Discussion

The above design considerations are presented as examples of the various considerations needed for modifications of Special Waste piping systems before cleaning or replacement activities are initiated. But before modifying any portion of its waste piping infrastructure, a facility should make a thorough inspection of any traps and horizontal piping runs (including analyses of biomass samples) to determine if the modification, cleaning, or replacement efforts should be done at all. If trap and biomass contaminations are found, the decision must then be made whether to pursue source reduction, source segregation, infrastructure replacement, infrastructure cleaning, and pretreatment as solutions to noncompliance with mercury sewer discharge limitations.

TRAP CLEANING PROCEDURES

Trap accumulations of elemental mercury and of biomass growth contaminated with mercury has been found to be a significant source of chronic elevated mercury concentrations in wastewater discharges. The trap cleaning procedures outlined below have been found to be of significant value in reducing the levels of mercury in affected wastewater discharges.

Trap Location / Identification

Trap locations are determined by preparing a detailed inventory of all Special Waste sources. Trap identification can be accomplished as part of the facility piping system audit discussed earlier. After all sources are identified, a facility Special Waste piping drawing should be generated with all traps identified by unique numbers. A master inventory of all traps should be generated to record and track all trap cleaning events. Each trap should be tagged or labeled with its unique number, cleaning date, and the name and signature of the person performing the cleaning. Additional information on a Trap Inventory Form could include the type and size of piping material. A typical Trap Inventory Form is included at the end of this section.

Removal of Elemental Mercury

Elemental mercury is sometimes discharged into sinks and floor drains when mercury-containing equipment breaks. Some elemental mercury sources include mercury thermometers, thermostats, electric switches, and blood pressure manometers. When a sink or floor drain trap is removed for the first time, it may contain elemental mercury, identifiable as a pool of heavy silvery liquid separated from the trap wastewater.

Elemental mercury removed from any traps should be collected and disposed as a mercury waste. Disposal of mercury wastes must be done in accordance with federal, state, and local requirements.



Removal of Biomass

Almost every trap will accumulate biomass, identified as a slimy brown film on the internal surface of the plumbing material. The bulk of this growth will occur on the bottom and wetted sections but some biomass will grow along the sides and top of the non-wetted section of the plumbing materials. This capillary action of growth is the most difficult to remove. Biomass growth on non-wetted surfaces can dry out. The dried out biomass develops a strong bond to the plumbing surfaces. Accordingly, some facilities may choose to replace, rather than attempt to clean, contaminated traps.

Trap Removal and Handling Precautions

Where wastewater is elevated in temperature or where chemical reactions producing heat may occur within a piping system, greater amounts of dimethyl mercury may be formed in accumulated biomass. Both elemental mercury and dimethyl mercury may exist in vapor form within the piping systems. Since negative pressures can sometimes exist in laboratory rooms, hazardous elemental or dimethyl mercury vapors can emanate from plumbing traps back into the rooms. Therefore, proper personnel protection should be practiced at all times. In addition, the traps should be of the deep seal type and should continually be filled to afford protection against possible vapor “draw-back.”

Trap Replacement or Cleaning Procedures

1. Identify traps for replacement or cleaning and discuss the trap removal procedure with the affected facility occupants. Explain to them that the procedure will interrupt their operations and estimate the duration of the interruption.
2. Before any traps are removed, it is important to ask the occupants about the nature of their wastes, identifying all possible health and safety hazards. Before handling traps that are in areas that contain hazardous materials, all traps should be checked by the appropriate administrator for approval (*i.e.*, if a radioactive isotope is being used in a room, have the Radiation Safety Department check out the trap to assure that it is safe for removal and handling).
3. After facility occupants have been made aware of the trap replacement or cleaning program and after it is determined that it is safe to handle traps, actual trap removal, replacement, and cleaning can be started.
4. It is important that personal protective equipment be worn at all times by any personnel doing trap handling. It is recommended that all these procedures be reviewed by an internal Health and Safety Officer.
5. All materials found inside the traps must be handled and disposed of as mercury waste. Disposal of mercury wastes must be done in accordance with federal, state, and local requirements.



6. If the removed trap is to be cleaned, either a rag or flexible brush can be used. A cleaning agent and some type of disinfectant may also be used to help ensure that complete removal of biomass and disinfection is accomplished.
7. After traps are removed, cleaned, and replaced, a tag or label should be wired to the trap (or an existing tag should be updated) with the unique number, date, and the responsible individuals' initials.
8. After trap removal, replacement, or cleaning is completed and the area is returned to its original condition, all access panels and other structural materials should be reinstalled. Before leaving the area, inform the occupants that the procedure has been completed.
9. All trap replacements or cleanings should be logged on the Trap Inventory Form.
10. If mercury-containing materials remain in use, it will be necessary to inspect the affected cleaned traps for recurring contamination of the biomass growth. These inspections could initially be performed quarterly. Once a sufficient level of experience has been obtained, inspection frequencies can either be increased or decreased depending on the levels of contamination and the rates of returning biomass. The inspections should help determine the need for repetition of the entire procedure.
11. Have spare traps available for replacement of corroded or otherwise unusable traps.



TRAP INVENTORY FORM

Institution Name _____

Address _____

Building Name

[illegible]

INFRASTRUCTURE POWER WASHING PROCEDURES

Because of the phenomena of bioaccumulation and bioconcentration, the biomass within a Special Waste piping system (that has been used for disposal of mercury-containing materials) may contain concentrations of mercury in the part per million range. Power washing has been used as a mercury control technique for such systems because of its scouring effect on the accumulated mercury-contaminated biomass. Power washing has been identified as a possible lower cost method of biomass control compared to replacement of the facility's waste piping system. However, because of the issues outlined below, power washing of waste piping systems may not be effective at all facilities.

Power washing uses special equipment that produces a high pressure/low volume stream of water. The water flows through a high pressure hose and a power nozzle to produce a high velocity spray that removes accumulated biomass and grease from the inside of waste conveyance piping while flushing the resulting debris down the line. Results of a power washing effort are dependent upon accessibility to the entire waste piping system (*i.e.*, through use of piping isolation valves, cleanouts, access ports, and drains). In addition, there are uncertainties in the ability of power washing to effectively remove all biomass residues thereby possibly exposing new surfaces from which mercury can reach the wastewater, and there is evidence that power washing may actually lead to new mercury violations from continued discharges of dislodged biomass particles.

Because of these issues, the MWRA will require prior notice of intended power washing by permitted dischargers. The MWRA is considering additional requirements including approval of power washing protocols and collection and offsite disposal of the facility wastewater during and after power washing until sampling and analyses show that mercury concentrations in the discharge have returned to the same levels or lower that existed before the power wash procedure. A possible alternate approach would be removal of dislodged biomass particles from the discharge possibly by sedimentation or multistage filtration.

The temporary or permanent particle removal system could be installed within the piping system or at the final discharge point. The particle removal system could be considered separately or as part of a mercury pretreatment system. The proposed installation of the particle removal system must be disclosed to the responsible POTW, however, since the POTW will likely consider the system to be a type of pretreatment system.

Some facilities have considered power washing to be an effective method for reducing mercury concentrations in their sewer discharges. If mercury-containing materials continue to be disposed to the waste piping system, however, the power washing procedure will not be a permanent solution and will likely have to be repeated on a continuing basis. If a facility should choose to engage in power washing, the following discussion should be referred to for precautions, recommended techniques, and possible compliance issues.



Power Washing Precautions

The following are some precautions that should be considered before starting power washing procedures:

- Waste conveyance piping accessibility is essential for successful power washing. Considerable modifications to an existing system may be needed to achieve the needed accessibility.
- Perhaps because of the potential for mercury to form an amalgam with other metals, power washing is not expected to be effective in waste piping systems constructed of metals (*i.e.*, high silicon cast iron or stainless steel). If a metallic waste piping system were mercury-contaminated, total replacement of the system should be considered.
- All substances contained within the waste conveyance piping should be taken as hazardous. Before power washing, the facility's Health and Safety Officer should review the proposed power washing procedure to ensure that proper personal protective equipment will be used.
- Waste conveyance fittings and piping, especially with glass fittings, can be cracked or broken during power washing. Inspect the entire run before power washing, and identify any potential obstructions, so that if a fitting is broken, a replacement fitting can be immediately available for installation.
- If the waste conveyance piping contains large amounts of biomass, dislodged pieces may collect and clog downstream conveyance piping sections. If such clogging occurs, there may be wastewater backups in the plumbing system causing flooding at lower elevation locations.
- Dislodged biomass particles can appear in the sewer discharge for some period after power washing. To avoid compliance problems from the power washing procedure, collection and offsite disposal of the affected wastewater may be needed until testing shows no elevated mercury levels. Alternately, the dislodged biomass particles could be removed from the discharge by a temporary or permanent removal system within the piping system or at the final discharge point. The proposed installation of a particle removal system, however, must be disclosed to the POTW since it likely will be considered a pretreatment system.
- Any proposed sanitizing or cleaning agents should be reviewed to prevent possible chemical interactions with waste constituents that may exist in the piping system. The potential for incompatible reactions should be considered to ensure that trap and pipe cleaning procedures will not create unsafe conditions. Reactions that may cause fuming and result in gas evolution into the working environment, as well as into the piping system, must be avoided.



Power Washing Techniques

The following techniques are easily monitored for effectiveness when performed on glass waste piping systems. The techniques may require some modification when applied to thermoplastic or other waste piping materials.

1. Power washing activities usually require a minimum of two people: one serving as the power wash operator; and the other as an observer of the nozzle and hose as it moves through the waste conveyance piping.
2. The operator begins feeding the 80 to 100 feet of hose with the power washing nozzle attached, while the observer, with a two-way radio in full communication with the operator, watches the hose and nozzle for potential obstructions and other problems. Typical obstructions include: tees, reducers, p-traps, drum traps and valves.
3. Some facilities have determined that successful power washing occurs when cleaning operations begin at the collection or treatment tanks in the lower floors. The operator then works in the waste piping system toward the sources in a reverse flow direction. This technique is preferred because the nozzle is designed with a reverse flow head configuration that literally “pulls” the hose away from the power washer operator and toward the sources while flushing biomass and debris down the line and to the collection point. In addition, most plumbing fittings have smooth swings in the reverse direction and this seems to reduce obstruction interference.
4. Although reverse flow is preferred, the complexities of the piping infrastructure may require some experimentation. For immediate progress, select straight sections observed to contain biomass. In other locations, piping may have to be removed or modified to reach all areas of concern. Power washing on thermoplastic piping will require more experimentation and it may be necessary to remove piping sections to verify cleaning effectiveness. The installation of sight glasses may help to reduce the required amount of pipe removal.
5. At times, it may be difficult or impossible to feed the hose and nozzle in the preferred reverse direction. An alternative method would then be to start at the sources (sink traps or floor drains) and work in the direction of flow. This technique, however, is less desirable because the nozzle head will not be directly flushing debris as it moves along the piping. It may be necessary, then, to apply additional water to aid the flushing process by turning on an adjacent sink tied into the same waste conveyance line.
6. Regardless of the direction that the power wash nozzle is fed into the system, a final wash and high volume rinse in the direction of flow may help to flush residual biomass particles from the system.



Chemical Addition

Bleach

Some power washing units are designed for use with water only and do not allow for addition of chemical solutions. However, it is recommended that a bleach solution be added to the piping at the source, if possible, to accomplish disinfection of the piping system before the power washing and aid in the removal of biomass. The bleach or other disinfecting chemical should be analyzed before use to ensure that it is mercury free or of a “low” mercury content. Unfortunately, some chemicals and reagents, including many disinfecting products that contain bleach, may contain measurable amounts of mercury.

Other Cleaning Solutions

The additions of surfactants, dispersants, caustics and/or wetting agents were investigated during the MWRA/MASCO Mercury Work Group Phase I effort. None of these chemicals were recommended then because of health and safety considerations. In addition, such chemical additions may be costly for waste piping systems at large facilities. However, some power washing companies may offer chemical addition services and facilities may find that chemical addition is quite feasible, safe, and effective.

Power Washing Wastewater Disposal

All power washing wastewater that contains removed biomass should be assumed to contain levels of mercury above the MWRA enforcement limit of 1.0 $\mu\text{g/L}$ (ppb) and, therefore, should be collected for offsite disposal. The collection of the power wash wastewater is difficult, but since power washing will usually occur during non-operating hours, the piping systems can virtually be drained. Once normal flow has stopped, existing neutralization or treatment tanks can be emptied and used as power washing wastewater collection vessels. Additional temporary collection vessels may be needed.

After power washing is completed or the treatment tanks get full, transfer all collected wastewater into storage containers. Other collection and pumping methods can be used on a case-by-case basis. However accomplished, it is very important that this wastewater be collected and not discharged.

In addition, dislodged biomass particles can sometimes appear in the sewer discharge for some period after power washing. To avoid compliance problems, collection and offsite disposal of the affected wastewater or removal of the biomass particles from the discharge may be needed. A temporary or permanent filtration system within the piping system or at the final discharge point should be considered. The proposed installation of a filtration system, however, must be disclosed to the POTW since it will likely be considered a pretreatment system.

All waste disposal activities should be approved by an Environmental, Health and Safety Officer or the person responsible for waste disposal. The MWRA prohibits the disposal of chemicals into the sewerage system except for aqueous solutions of nontoxic and nonhazardous chemicals.⁷ In addition, the Massachusetts Department of Environmental Protection (MA-DEP) prohibits the improper disposal of hazardous wastes.⁸

⁷ MWRA Sewer Use Regulations: 360 CMR 10.000.

⁸ MA-DEP Hazardous Waste Regulations: 310 CMR 30.000.

APPENDIX P

Strong Memorial Hospital (SMH) Mercury Spill Clean-Up Procedures

Revised November 1996

Broken Thermometers: (There is not enough mercury involved to present a hazard; you do not need to respond with the vacuum.)

1. Using two 3" x 5" cards push mercury into a pile.
2. Draw up into a syringe (no needle) and place in a sealed container or scoop into a specimen container or other sealable container.
3. Disposal:
Non-patient area: Fill out a hazardous waste tag and call the
Hazardous Waste Management Unit for pick up.
Patient area: Label container (mercury) and place on cart to be returned to Sterile Supply.

Broken Manometers:

SMH patient area: Call should be referred to SMH Housekeeping.
Other area: Contact an Industrial Hygienist for immediate clean-up.

****Note:** Any call which sounds unusual (i.e. spilled on patient, on carpet, in toilet, not a thermometer or manometer) should be referred to an Industrial Hygienist.

It is important to respond as soon as possible (within 1 or 2 hours) to clean-up any spill.

1. Make sure everyone is removed from the room (patient(s), visitors, staff).
Patient bed should **not** be removed from the room.
2. Gather equipment
 - Mercury vacuum* and attachments (stored in the SMH Housekeeping Office--
If locked have one of the supervisors paged)
 - The mercury vacuum is designed to clean up liquid mercury spills.
Regular vacuum cleaners can volatilize the mercury and blow the mercury vapors into the air. An activated carbon filter in this vacuum will absorb and contain the mercury vapors.



- Tool box. The following items should be in the tool box:
 - Flashlight
 - Screwdriver
 - Putty knife
 - Mercury holding jar
 - Respirator (3M 9908 Dust/Mist Respirator)
 - Yellow or pink wash basin (from clean utility room on unit)
 - Heavy plastic bag
- 3. Before entering room put on protective equipment.
 - Respirator
 - Long sleeve shirt
 - Long pants
 - Disposable gloves
 - Remove all jewelry
- 4. Assess the extent of the spill. Upon entering the room use flashlight (hold angled at floor level, put head close to floor to see where mercury is located). Also check wall, bed frame and mattress. Do not walk in contaminated areas.

If there is anything unusual about the spill (i.e. on carpet, in a toilet, on patient, etc.) a member of the Industrial Hygiene Unit should be consulted.

5. Set up mercury vacuum using the following steps:
 - A. Place plastic dishpan under separator.
 - B. Remove red cap off mercury separator and screw jar onto vacuum.
 - C. Remove red end cap from hose.
 - D. Place required attachment on hose.
6. Begin vacuuming at outer edges of spill and work towards center of spill (usually the wall under the manometer). Set up an organized approach (i.e. begin vacuuming one block and move slowly, in a row to assure that you cover the entire area). Draw vacuum hand-piece slowly towards yourself. Pay special attention to floor moldings. If molding is pulled away from the wall and you suspect that mercury may have gotten behind it, remove the molding using the putty knife and vacuum behind it.
7. Once the area under the manometer has been vacuumed, remove the manometer from the wall bracket by unscrewing the top holding screw. Place the manometer in the wash basin. If the glass tube is not broken on the front of the manometer and there is no visible mercury on the outside of the manometer, put the manometer inside the plastic bag. Seal the bag and place in wash basin. If the tube is broken, empty mercury into the wash basin to be vacuumed. Then put the manometer into plastic bag and seal.



8. Once all the mercury has been vacuumed, take the flashlight and check again for beads of mercury on the floor, wall and bed. Several attempts may be needed to vacuum all of the mercury from a spill.
9. Place wash basin under mercury separator and unscrew jar. Place red cap over bottom of mercury separator and place red end cap on hose. Any mercury that may have fallen on the paper should be dumped into the jar. Place lid on jar and return jar to tool box*.

If water has been vacuumed, notify Environmental Health and Safety (EH&S) immediately so that the appropriate maintenance can be performed.

Removal of the jar after each use will extend the life of the activated charcoal filter.

10. Pick up all materials and leave room.
11. Leave manometer (in sealed bag) in the soiled utility room. The unit secretary should be informed to call to have the manometer replaced.
12. Post sign on the door to assure that the room remains browned out and no one enters until EH&S has checked the room.
13. Notify EH&S that the spill has been cleaned up. If the spill occurs during the normal 8-5:30 day, call EH&S immediately after clean up is complete. Please give the secretary the room number and other important details. If the spill occurs after 5:30 or on a weekend, leave a message on phone mail giving the room number and any other details about the spill.
14. EH&S will respond with the mercury vapor sniffer and a flashlight to assure adequate clean up. Mercury vapor levels should be insignificant ($<0.02 \text{ mg/m}^3$) at floor level.
15. The patient(s) may be returned to the room after EH&S has approved the room for use.

*Note: If mercury and spill debris reach the fill line on the jar, a Hazardous Waste Tag must be filled out. The tag should be completely filled out and attached to the jar. The Hazardous Waste Management Unit should be called to pick up the mercury.



Mercury Spills Special Circumstances

Carpeting:

- Following the above directions, vacuum up as much of spill as possible.
- Check using mercury vapor sniffer.
- Re-vacuum.
- If, after vacuuming 3 times, levels remain elevated, the carpeting will need to be removed. Pull carpet up carefully and place into a plastic bag.
- Re-vacuum floor under carpet.
- Check levels using mercury vapor sniffer.
- If the breathing zone level is $<0.02 \text{ mg/m}^3$ then the room will be considered clean.

**** Note:** If it is an area where children will be crawling on the floor,
then the mercury vapor level taken at the floor should also be less than $.02 \text{ mg/m}^3$.



Appendix Q

Glossary of Terms

Aneroid: Operates by the effect of outside air pressure on a diaphragm forming one wall of an evacuated container. Uses no liquid.

Best management practices: Proven strategies that prevent or reduce the use, release or transport of toxic substances that adversely impact the environment.

Bioaccumulate: To accumulate a substance in the tissues of an organism as a result of uptake from all environmental sources.

Biosphere: The part of the world in which life can exist.

Mercury loading: The amount of mercury that enters a water body per unit of time, such as pounds/year.

Pollution prevention: Use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste and reduce overall risk to human health and the environment. Includes source reduction, recycling, reuse, reclamation or modification of operating practices.

Source reduction: Waste prevention. Any activity that eliminates or decreases wastes by avoiding their creation.

Toxicity Characteristic Leaching Procedure (TCLP): Test used to determine the ability of a substance, such as mercury, to leach from waste in a landfill.



Appendix R

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